PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION

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DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled "**PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION**" submitted towards partial fulfillment of the requirements for the award of **MD in Anaesthesiology** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Neeru Luthra**, Professor, Department of Anaesthesiology, **Dr. Namrata**, Associate Professor, Department of Anaesthesiology and **Dr. Anju Grewal**, Professor & Head, Department of Anaesthesiology. No part of this thesis has formed the basis for the award of any degree previously.

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Dedicated

to

my Family

&

Teachers

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Dr. Sandeep Singh

LIST OF ABBREVIATIONS

mcg	microgram/micrograms
%	Percentage
ASA	American Society of Anesthesiology
BMI	Body Mass Index
CI	Confidence interval
CRT	Capillary refill time
DBP	Diastolic Blood Pressure
HR	Heart Rate
HRV	Heart rate variability
Hr	Hour
i.e	That is
IV	Intravenous
Kg	kilogram/kilograms
L	Litre
LSCS	Lower segment caesarean section
MAP	Mean Arterial Pressure
mg	milligram/milligrams
Ml	milliliter/millilitres
min	Minute
Mmol	Millimol
mmHg	Millimeters of mercury
NIBP	Non invasive blood pressure
O_2	Oxygen
PI	Perfusion Index
PVI	Pleth Variability Index
PPI	Peripheral perfusion index
PDA	Patent Ductus Arteriosus
PFI	Peripheral flow index
SV	Stroke volume
SAB	Subarachnoid block
Sec	Second

SD	Standard deviation
SpO_2	Peripheral oxygen saturation
SBP	Systolic blood pressure

ABSTRACT

Introduction: Perfusion Index (PI) can be used to assess peripheral perfusion dynamics as it depicts the changes in peripheral vascular tone. Parturients with higher baseline PI have been reported to have lower peripheral vascular resistance and hence are at a higher risk of developing hypotension following subarachnoid block (SAB). We proposed to evaluate PI as a non-invasive tool for predicting incidence and severity of maternal hypotension following SAB in parturients undergoing lower segment caesarean section(LSCS).

Aim of Study: To evaluate the correlation of PI and SAB induced hypotension in LSCS.

Materials & Methods: A prospective, observational study was conducted on 120 ASA-II parturients undergoing LSCS under SAB. Systolic Blood Pressure (SBP), Mean Arterial Pressure (MAP), and PI wererecorded at baseline and at one minute interval till the delivery of baby. Episodes of hypotension, bradycardia, total amount of vasopressor consumption,intra-operative nausea, vomiting (IONV) and APGAR scores were observed.

Results: The incidence of hypotension in parturients with a higher baseline PI(>3.82) was 79.1%as compared to 20.9% with low baseline PI(<3.82). There was significant correlation between baseline PI >3.82 and number of episodes of hypotension ($r= 0.552, p<0.001$) and total dose of ephedrine($r=0.452, p<0.001$) The optimal cutoff point across a range of cutoff points for PI was found to be 3.82 with a sensitivity of 79.07% and specificity of 72.73%. The area under the ROC curve for PI to predict hypotension was 0.798.

Conclusion: There is a significant correlation between perfusion index and subarachnoid block induced hypotension in parturients undergoing lower segment caesarean section. Parturients with higher baseline PI value are at a greater risk of developing hypotension.

Keywords: Perfusion Index (PI), Subarachnoid block (SAB), Hypotension, lower segment caesarean section (LSCS).

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-4
II	AIMS AND OBJECTIVES	5
III	REVIEW OF LITERATURE	6-14
IV	MATERIALS AND METHODS	15-19
V	OBSERVATIONS AND RESULTS	20-39
VI	DISCUSSION	40-45
VII	SUMMARY AND CONCLUSIONS	46-48
VIII	BIBLIOGRAPHY	49-54

APPENDICES – I

- PROFORMA
- MASTER CHART

APPENDICES – II

- APPROVAL LETTER OF THESIS PLAN
- THESIS PLAN

LIST OF TABLES

S. NO.	TOPIC	PAGES.
1	Demographic profile of subjects included in the study	20
2	The mean of baseline vital parameters	21
3	Incidence of hypotension	22
4	Dose of iv ephedrine (mg) administered in parturients experiencing hypotension	23
5	Incidence of bradycardia and treatment given	24
6	Incidence and grading of IONV	25
7	Intervention of IONV(Dose of Ondansetron (mg) given)	26
8	The correlation between baseline PI and degree of decrease in SBP	27
9	Area under the ROC curve for the mean PI	28
10	Association of hypotension with PI	29
11	Correlation between PI and dose of ephedrine administered for hypotension	30
12	Correlation between PI and amount of crystalloid (ml) given	31
13	Correlation between PI and incidence of IONV	31
14	Trends of mean values of intraoperative systolic blood pressure (SBP) (mmHg) and association with PI	32
15	Trends of mean values of intraoperative diastolic blood pressure (DBP) (mmHg) and association with PI	34

16	Trends of mean values of intraoperative mean arterialpressure (MAP) (mmHg) and association with PI	36
17	Trends of mean values of intraoperative heart rate (HR) (bpm) and association with PI	38
18	Correlation between PI and neonatal outcome (APGAR SCORE)	39

LIST OF FIGURES

S. NO.	TOPIC	PAGES.
1	Incidence of hypotension	22
2	Dose of iv ephedrine (mg) administered in parturients experiencing hypotension	23
3	Incidence of bradycardia and treatment given	24
4	Incidence and grading of IONV	25
5	Intervention of IONV(Dose of Ondansetron (mg) given)	26
6	The correlation between baseline PI and degree of decrease in SBP	27
7	ROC curve depicting baseline PI against incidence of hypotension	28
8	Association of hypotension with PI	29
9	Correlation between PI and dose of ephedrine administered for hypotension	30
10	Trends of mean values of intraoperative systolic blood pressure (SBP) (mmHg) and association with PI	33
11	Trends of mean values of intraoperative diastolic blood pressure (DBP) (mmHg) and association with PI	35
12	Trends of mean values of intraoperative mean arterialpressure (MAP) (mmHg) and association with PI	37
13	Trends of mean values of intraoperative heart rate (HR) (bpm) and association with PI	38

INTRODUCTION

Providing safe and adequate anaesthesia in obstetric patients is very challenging for every anaesthesiologist. [1] Subarachnoid block (SAB) is the anaesthetic technique of choice for parturients undergoing elective lower segment caesarean section (LSCS). [2] It is fast,reliable and cost effective. However, the reported incidence of hypotension that ensues immediately after SAB is around 70-80%. [3-5] Hypotension is even more common in pregnancy because the physiological changes of pregnancy leads todecreased peripheral vascular tone, hencetrapping of blood volume in the extremities making the parturients vulnerable to various intra-operative upheavals that often complicate and threaten the lives of the mother and the fetus even before the administration of SAB. These are further aggravated following the onset of a sympathetic blockade. [6] Sympathetic blockade leads to hypotension and is associated with significant maternal complications such as nausea,vomiting and decrease in utero-placental blood flow, foetal acidosis and rarely , maternal cardiovascular collapse. [7] It is imperative that this hypotension is promptly treated to prevent decrease in placental perfusion and adverse effects on the fetus. [2] The standard method of monitoring intra-operative haemodynamics is noninvasive blood pressure (NIBP) which is intermittent and thus may fail to detect episodes of hypotension in a timely fashion furthermore NIBP does not measure beat to beat variation in haemodynamics. [8]

The ability to predict and categorize the patients who are at particular risk of developing severe hypotension would enable anaesthetists to prepare appropriately, and also to potentially individualise treatment modalities. [9] Many attempts have been made to look for predictors of hypotension in subarachnoid block. [3] Some of the predictors of hypotension are advanced age, baseline heart rate (HR), heart rate variability (HRV), body mass index (BMI), pleth variability index (PVI), preoperative anxiety. [10-18]

One novelpredictor which has shown promise is the use of perfusion index (PI) which effectively assesses peripheral perfusion dynamics and vascular tone. [3] It is a non-invasive modality studied using pulse oximeter. [19]

Perfusion index (PI) is defined as the ratio of pulsatile blood flow to non pulsatile blood flow in the peripheral vascular tissue, measured using a pulse oximeter based on the amount of infrared light absorbed. [1,19-21] The principle is similar to that of peripheral oxygen saturation (SpO_2) which is based on two light sources of different wavelength (660nm and 940 nm) emitted through cutaneous vascular bed. Both wavelengths have a pulsatile component representing the fluctuations of arterial blood and non pulsatile component from connective tissue, bone and venous component.[19-21]

Lima et al investigated the use of peripheral perfusion index (PPI) derived from the pulse oximetry signal as a noninvasive indicator of perfusion. They significantly correlated the variation of the PPI in healthy adults to the central-to-toe temperature difference and capillary refill time in critically ill patients after changes in clinical signs of peripheral perfusion. [22]

Genderen et al demonstrated the ability of pulse oximeter-derived peripheral perfusion index (PPI) as a valuable diagnostic tool to detect clinically significant central hypovolemia, before the onset of cardiovascular decompensation in awake healthy volunteers. Peripheral vasoconstriction is an early warning sign of circulatory shock in critically ill patient, when blood flow is diverted from less important tissue to maintain vital organ perfusion at the cost of peripheral circulation. Hence, they proved that early detection of hypovolemia can be done by using PPI. [23]
Gravid uterus is also associated with vasodilatation and decrease in systemic vascular resistance, that leads to increased pulsatile component and corresponds to higher PI values. [21,24-26] Hence, parturients having

higher baseline PI values have lower peripheral vascular tone and are at a higher risk of developing hypotension after the administration of SAB.[20] Hanss R et al suggested that haemodynamic changes of spinal anaesthesia for caesarean section are influenced not only by volume status and sympathetic activity but also by vascular tone. The reduction of systemic vascular resistance and hypotension may vary in pregnant women and is dependant on various factors likepreoperative sympathetic activity, peripheral vascular tone and preoperative volume status.[11] Several studies using plethysmography have demonstrated a reduction in peripheral vascular tone as a cause of hypotension. But the technique is invasive and is not readily available forclinical management in the elective settings. In contrast, non-invasive plethysmographic pulse wave monitoring is found in most pulse oximeters and is readily available for routine use. The oximetry- derived perfusion index is a quantitative value of photoplethysmography waveform that reflects the real time changes in pulse strength at monitoring site and can be used to detect the likelihood of development of hypotension following SAB. [3,8,27]

Some studies have used pulse oximeters to evaluate the perfusion index and its usefulness in predicting hypotension following spinal anaesthesia in caesarean section. Ginosar et al investigated the role of perfusion index as an early indicator of sympathectomy after epidural anaesthesia. They demonstrated that pulse oximeterderived Perfusion index is a sensitive test for early detection of sympathectomy following epidural anaesthesia in comparison to skin temperature and arterial pressure. [28]

Xu et al demonstrated the differential role of right and left toe perfusion index in predicting the incidence of postspinal hypotension during LSCS. As we know aortocaval compression by the gravid uterus, low baseline vasomotor tone, and spinal anaesthesia-related sympathetic blockade are the contributing factors for spinal anaesthesia-induced hypotension during caesarean delivery. They concluded that baseline toe Perfusion index was

directly associated with the incidence of postspinal hypotension. Continuous monitoring of toe perfusion index during induction of spinal anaesthesia might help to predict the development of postspinal hypotension and reflect the aortocaval compression by the gravid uterus.[29]

Up till now there have been limited studies comparing PI values and the incidence of hypotension in pregnant patients undergoing LSCS under SAB.

A study conducted by Toyama et al on 39 parturients for LSCS, used PI to predict incidence of hypotension under SAB. They observed an association of a higher baseline PI (>3.5) and profound hypotension and concluded that baseline PI could predict the incidence of SAB induced hypotension. [19]

In another study conducted by Duggappa et al, parturients were divided into two groups based on PI value <3.5 and >3.5.This study found a significant correlation between baseline PI>3.5 and number of episodes of hypotension. [20]

These studies showed that PI can aid in the assessment of baseline vascular tone and volume status and thus serve as a non-invasive tool for prediction of severity of hypotension followingSAB in pregnant women. Due to paucity of studies validating this tool in the above context we propose to evaluate the correlation of PI with SAB induced hypotension in parturients undergoing LSCS.

AIMS AND OBJECTIVES

To evaluate the correlation of perfusion index and subarachnoid block induced hypotension in lower segment caesarean section.

REVIEW OF LITERATURE

Spinal anaesthesia remains popular for elective caesarean section as it provides rapid, reliable profound sensory and motor blockade.[30] The major adverse effect of spinal anaesthesia for parturients is hypotension. It complicates up to 80% of SAB administered LSCS. Maternal hypotension leads to utero placental hypoperfusion and provokes an acute fall in intervillous blood flow with subsequent fetal hypoxia, acidosis and neurological injury. [7,31-33]

According to traditional teaching, spinal hypotension was hypothesized to occur due to decrease in venous return and cardiac output. Holmes et al[34] and Lees et al [35] attributed SAB induced hypotension to compression of the vena cava by gravid uterus which impedes the venous return along with venous pooling of blood in lower limbs, leading to decreased VR, fall in cardiac output and hypotension. Marx suggested that neuraxial blockade results in venous pooling of blood in lower limbs, leading to decreased venous return and fall in cardiac output. [36]

Several strategies for prevention and treatment have been described but there appears to be no consensus on which of these is most effective. The clinicians have used various methods and techniques such as leg wrapping, elastic stockings, optimizing patient's position, intravenous fluids and vasopressors from time to time to offset these hypotensive effects of spinal anaesthesia with varying degree of success. One of the foremost method includes prophylactic administration of intravenous fluids before implementation of subarachnoid block to offset the hypotensive effects of sympathectomy by maintaining intravascular volume. [37,38]

Park et al conducted a randomized double blind study to find the effects of varying volumes of crystalloid administration before caesarean delivery on maternal haemodynamics and colloidal osmotic pressure. They concluded that increasing crystalloid volume and decreasing colloid osmotic pressure raises the risk of maternal and fetal pulmonary edema. [39]

Ni H F et al performed a meta-analysis to compare crystalloid co-load with crystalloid preload in parturients receiving SAB for LSCS. The primary outcome was intraoperative incidence of hypotension. Other outcomes were intraoperative need for vasopressors, haemodynamic variables, neonatal outcomes (umbilical artery pH and APGAR score), and incidence of nausea and vomiting. Ten studies with 824 cases were included. The incidence of hypotension was significantly higher in the preload group (57.8%) compared with the co-load group (47.1%). [40]

According to Starling's law, the exchange of fluid is determined by capillary and interstitial fluid hydraulic pressure and oncotic pressure. Bajwa et al cleared a therapeutic dilemma regarding co-loading and pre-loading for prevention of hypotension after spinal anaesthesia. Crystalloid preload may induce atrial natriuretic peptide secretion, resulting in peripheral vasodilatation, followed by an increased rate of excretion of fluid. Further, fluid loading does not increase the intra-vascular volume at the time of maximum vasodilatation. On the other hand, the arterial pressure was better maintained by a fluid bolus just after anaesthesia induction compared to preload. Thus they suggested that crystalloid preloading or no fluid administration is less effective than crystalloid co-load for preventing spinal hypotension. [38]

Dyer et al examined the relevance of the timing of the fluid administered. In this study 50 parturients were randomly allocated to receive either 20ml/kg of crystalloid solution 20 minutes prior to induction of subarachnoid block (preload), or an equivalent volume by rapid infusion immediately after induction of SAB (co-load). Significantly more patients in the co-load group did not require vasopressor therapy predelivery ($p=0.047$). The co-load group required a lower median dose ($p=0.03$) and a lower median number ($p=0.04$) of ephedrine dose for the treatment of maternal hypotension predelivery. [41]

Similar study with same amount of preload and co-load crystalloid volumes was conducted by Khan et al on 100 parturients and found incidence of hypotension in preload group as 70% compared to 44% in co-load group. So, the investigators concluded that rapid crystalloid administration after the induction of SAB for LSCS may be advantageous in comparison to preloading 20 minutes prior to institution of SAB in term of managing maternal blood pressure prior to delivery. Hence intra-venous fluid administration including crystalloid co-loading were recommended to prevent maternal hypotension following SAB. [42]

Many attempts have been made to look for predictors of hypotension in subarachnoid block. Some of the studied predictors are baseline heart rate (HR), heart rate variability (HRV), body mass index (BMI), pleth variability index (PVI) , advanced age and preoperative anxiety. [10-18]

Frolich et at conducted a prospective trial on forty women scheduled for elective caesarean section to predict the incidence of hypotension after spinal anaesthesia using baseline heart rate as a predictor. Haemodynamic parameters were correlated to ephedrine requirements. They concluded that higher baseline HR, possibly reflecting a higher sympathetic tone, may be a useful parameter to predict postspinal hypotension but they failed to correlate the degree of orthostatic changes in mean arterial pressure and HR with postspinal hypotension. [10]

Another prospective study done by Hanss et al on 105 patients to guide prophylactic treatment of severe hypotension after SAB for LSCS using HRV as a predicting parameter. Baseline low to high frequency ratio (LF/HF) of heart rate variability was used to guide the management of SAB induced hypotension. They found that the patients with high baseline LF/HF ratio were at high risk of hypotension. So heart rate variability can be used as a guide for the management of spinal induced hypotension. [11]

Nani et al studied the correlation between the BMI of pregnant women and the development of hypotension after spinal anaesthesia for caesarean section. The study was conducted on 100 parturients by dividing into two groups of pregestational BMI <25 kg/m^2 and >25 kg/m^2. Pregestational BMI >25kg/m^2 was found as a risk factor for hypotension after spinal anaesthesia.

Yokose et al conducted a observational study to find the predictive ability of different non-invasive haemodynamic parameters such as heart rate, perfusion index, pleth variability index, heart rate variability for hypotension during LSCS. [13] They found that pre-anaesthetic heart rate is a prognostic factor for hypotension associated with spinal anaesthesia, while other parameters remain non predictive for hypotension.

Broch et al investigated the role of different invasive and non-invasive dynamic variables with regard to their ability to predict fluid responsiveness. The noninvasive variable of fluid responsiveness like pleth variability index (PVI) strongly relates to respiratory variations in arterial pulse pressure. He demonstrated the limited capabilities of PVI to predict fluid responsiveness in the presence of low perfusion indices. By using perfusion index, PVI improved its ability to discriminate between responders and non responders. [14]

In contrast Kuwata et al [15] and Zang et al [17] demonstrated the good predictive ability of PVI to predict the spinal induced hypotension in patients undergoing caeserean section.

Perfusion index (PI) is defined as the ratio of pulsatile blood flow to non pulsatile blood blow in the peripheral vascular tissue, measured using a pulse oximeter based on amount of infrared light absorbed. This is one of the novel non-invasive predictor which has shown promise in assessing peripheral perfusion dynamics and vascular tone.

Genderen et al investigated the role of PI to detect the progressive reductions in central blood volume in healthy volunteers. It was acheived by inducing stepwise lower body negative pressure. Stroke volume (SV), Heart rate (HR), mean arterial pressure (MAP) were also recorded using volume clamp finger plethysmography. Assessment of Peripheral Perfusion Index (PPI) was done by pulse oximetry. The magnitude of PPI decrease was statistically different from that observed for SV and HR. PPI remained low throughout the reminder of protocol. They found it to be a diagnostic tool which could detect early clinically significant central hypovolemia, before the onset of cardiovascular decompensation. Thus the pulse oximeter derived PPI can be a valuable adjunct for detecting acute haemodynamic changes due to hypovolemia even before onset of cardiovascular decompensation in varied variety of clinical settings. [23]

Buyukeren et compared the perfusion index and echocardiographic parameters in preterm infants with hemodynamically significant patent ductusarteriosus(PDA). They demonstrated that difference between PI values in right hand and right leg obtained by pulse oximetry has diagnostic value in hemodynamically significant PDA and can assist diagnosis when echocardiography is not available. They conducted a prospective study on 66 preterm neonates. The delta PI cutoff values for diagnosis of haemodynamically significant PDA were 0.47 on day 1 (91.3% specificity; 90.5% sensitivity), 0.41 on day 3(100% specificity; 97.3% sensitivity) and 0.47 on day 7 (90% specificity; 10% sensitivity). [43]

Mwafi et al found that PI is a reliable alternative to conventional haemodynamic criteria for detection of an intravascular injection of epidural test dose in propofol anaesthetized adults patients. They conducted a study on forty patients scheduled for elective general surgery under total IV anaesthesia and patients were randomized to receive either 3 mL of lidocaine 15 mg/ml with epinephrine 5 mcg/ml or 3 ml of saline IV (n = 20 each). HR, SBP, and PI were monitored for 5 min after injection.

Injecting the test dose resulted in an average maximum PI decrease by (65% +/- 13%) at (39 +/- 15)sec. Moreover, maximal increases in HR and SBP were (19 +/- 8) bpm at (49 +/- 25) sec and (17 +/- 7) mm Hg at (102 +/- 34)sec after test dose injections, respectively. Using the PI criterion for intravascular injection (positive if PI decreases >or=10% from the pre-injection value) the sensitivity, specificity, positive predictive, and negative predictive values were 100% (95% confidence interval [CI]; CI = 83%-100%). On the contrary, sensitivities of 95% (CI = 76%-99%) and 90% (CI = 70%-97%) were obtained based on HR and SBP criteria, respectively.[44] Xu et al demonstrated that baseline toe PIs were inversely associated with the incidence of postspinal hypotension during caesarean delivery. Continuous monitoring of toe PIs during induction of spinal anaesthesia might help to predict the development of postspinal hypotension and reflect the aortocaval compression by the gravid uterus. They conducted a study on one hundred parturients undergoing elective caesarean delivery. The relationship between baseline toe PI and the incidence of hypotension after induction of spinal anaesthesia was quantified using area under the receiver operator curves, and results compared for the right and left toe PIs. The area under the receiver operator curves for left and right toe baseline PIs were 0.81 (95% confidence interval, 0.71-0.88) and 0.76 (95% confidence interval, 0.66-0.84), respectively. After induction of spinal anaesthesia, the toe PIs did not change in parturients with hypotension, but increased significantly among those who did not develop hypotension. [29]

Galvin et al investigated the usefulness of peripheral flow index (PFI) measurement using a standard pulse oximetry digit probe for early prediction of successful regional blocks. They conducted a study on sixty six patients who underwent either axillary or sciatic block for limb surgery using a nerve stimulator technique with mepivacaine 1.5%. PFI, which is the ratio of the pulsatile versus the nonpulsatile component of the pulse oximetry signal, was recorded from 10 min before block insertion until 30

min afterwards. PFI recordings of the unblocked limb were similarly recorded. Pinprick and cold sensation were assessed at 5-min intervals until 30 min after blockade. An increase in PFI by a factor of 1.55 at 10 min after axillary block placement (P = 0.006), and 12 min after sciatic block placement (P = 0.001) was required to predict a successful block. The sensitivity and specificity of PFI was 100% for predicting axillary block outcomes at this time. Positive predictive value was 95% and negative predictive value was 93%. For sciatic blocks, sensitivity and specificity were 90% and 100%, respectively. The calculated positive predictive value at time 12 min for sciatic blocks was 94% and negative predictive value was 92%. At 15 min after block placement, cold and pinprick sensations had the same calculated values for sensitivity and specificity at 71% and 100%, respectively, for axillary blocks. For sciatic blocks, cold sensation had a sensitivity of 77% and a specificity of 100%, whereas pinprick had a sensitivity of just 20% with a specificity of 100%. [45]

Similar study conducted by Ginosar et al demonstrated the potential utility of pulse oximeter derived perfusion index as an early indicator of sympathectomy after epidural anaesthesia. [28]

Lima et alfound that perfusion index can reflect clinical signs of decreased peripheral perfusion in critically ill patients. They conducted a study on 108 healthy adult volunteers and 37 adult critically ill patients and divided them into two groups. A total of 216 measurements were carried out in group 1, 74 measurements were carried out in group 2. Capillary refill time (CRT), peripheral perfusion index (PPI) and arterial oxygen saturation were measured in healthy adults (group 1). CRT, PPI, arterial oxygen saturation, central-to-toe temperature difference and hemodynamic variables were measured in critically ill patients (group 2) during different PPI profiles. The distribution of the PPI was skewed and values ranged from 0.3 to 10.0, median 1.4 (inner quartile range, 0.7-3.0) in healthy population. Changes in PPI and changes in core-to-toe temperature

difference correlated significantly (R^2 = 0.52, $p<0.001$). Therefore, PPI measurements can be used to monitor peripheral perfusion in critically ill patients. [22]

Toyama S et aldemonstrated that healthy pregnancy is characterized by a decrease in systemic vascular resistance and increases in total blood volume and cardiac output. However pregnant women, particularly after 30 weeks of gestation, have more blood volume trapped in extremities due to the pregnancy-induced decrease in vascular tone. Toyama did regression analysis and ROC curve analysis and concluded that a baseline perfusion index cut-off point of 3.5 could be used to identify parturients at risk for such hypotension. In order to predict incidence of hypotension using perfusion index, Toyama studied 39 parturients and found that parturients with baseline PI >3.5 had marked hypotension after SAB (using hyperbaric bupivacaine 10 mg and fentanyl 20 microgram) with sensitivity and specificity of 81% and 86% respectively. Thus he concluded that incidence of SAB induced hypotension can be predicted using baseline PI. [19]

Varghese et alshowed that peripheral vascular tone can be measured by plethysmography, but the technique is invasive and is not readily available for clinical management in the elective settings. In contrast, non-invasive plethysmographic pulse wave monitoring is found in most pulse oximeters and is readily available for routine use. They conducted a study on 60 parturients divided into two groups on basis of PI. Group 1 included those with PI>3.5 and group 2, those with PI<3.5. The incidence of hypotension is 86.67% in group 1 whereas it is 6.67% in group 2. The sensitivity and specificity of baseline PI of 3.5 to predict hypotension was 86.67% and 93.33% respectively. Varghese concluded that PI can be used as a predictor of hypotension in parturient during SAB for LSCS. The parturients with baseline PI >3.5 are at higher risk of developing hypotension following SAB compared to those with baseline PI<3.5. [21]

Similar prospective observational study was conducted by Duggappa et alon 126 parturients divided into two groups on the basis of baseline perfusion index. [20] The cut-off value of baseline perfusion index for prediction of hypotension following spinal anaesthesia was chosen as 3.5 based on a study conducted by Toyama et al. Group 1 included parturients with PI of <3.5 and group 2 , parturients with PI value of >3.5. SAB was performed with 10mg of injection bupivacaine 0.5% (hyperbaric) at L3-L4 interspace. Statistical analysis was performed using Chi-square test, independent sample t-test and Mann-Whitney U test. Spearman's rank correlation coefficient was done to assess the correlation between baseline PI and hypotension. The incidence of hypotension in group 1 was 10.5% compared to 71.42% in group 2 ($p<0.001$). They found that there was significant correlation between baseline PI>3.5 and number of episodes of hypotension (r_s0.416, $p<0.001$) and total dose of ephedrine (r_s0.567, $p<0.001$). The sensitivity and specificity of baseline PI of 3.5 to predict hypotension was 69.84% and 89.29%, respectively. The area under ROC curve for PI to predict hypotension was 0.848. [19]

The physiological objective during spinal anaesthesia for caesarean section is the maintenance of cardiac output, and more specifically uteroplacental blood flow, although heart rate is usually used as a surrogate index of cardiac output. A judicious combination of fluid loading and vasopressor therapy appears the most logical method of achieving this objective. Taken together, these studies suggest that, perfusion index can be used as a tool for predicting hypotension in healthy parturients undergoing LSCS under SAB. The use of PI can aid in the assessment of baseline vascular tone and volume status and thus needs to be evaluated as a non-invasive validated tool for prediction of severity of hypotension following SAB in pregnant women.

MATERIALS AND METHODS

SOURCE OF DATA

A prospective observational study was conducted in the department of Anaesthesiology, Dayanand Medical College & Hospital, Ludhiana after approval by Institutional Ethics Committee. A total of 120 parturients undergoing lower segment caesarean section (LSCS) under subarachnoid block (SAB), were recruited. A written informed consent was obtained from each parturient.

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA:

- American society of Anaesthesiologists (ASA) physical status II undergoing LSCS under SAB.
- Age>18 years.
- Body Mass Index (BMI) < 50 Kg/m^2.
- Singleton caesarean delivery.
- Gestational age 35-40 weeks.

EXCLUSION CRITERIA:

- Pre-eclampticparturients.
- Cardiovascular or Cerebrovascular disease.
- Placental implantation abnormalities including placenta previa, placenta accreta and placenta percreta
- Any contraindication to spinal anaesthesia.

Preanaesthetic checkup

A thorough preanaesthetic checkup was conducted comprising of detailed history (co-morbidities, allergy to any drug being used), general physical and systemic examination. Parturients were explained about the study being conducted and written informed consent was taken. Relevant investigations were sent.

Anaesthesia technique

The study was conducted on parturients posted for LSCS under SAB. On arrival in the operating room, the baseline PI was noted on the right index finger using pulse oximeter probe (Masimo® Rad-97, mexico). Parturients were positioned on the operating table in supine position with a 15 degree left lateral tilt and intravenous (iv) access was gained using 18-G cannula in right forearm or hand. Standard monitoring with 5 lead electrocardiography, automated noninvasive blood pressure(NIBP), pulse oximetry using the same Masimo® Rad-97 monitor to measure peripheral oxygen saturation (SpO_2) and PI was instituted. NIBP was measured on the left arm (opposite to that used for recording PI).

The mean of three consecutive readings of systolic blood pressure (SBP) at 1 min interval was taken as the baseline value. Parturients were administered SAB in sitting or lateral position using full aseptic precautions. All parturients received crystalloid co-load of 15ml/kg via a pressurised set to administer the fluid at the maximum possible rate while placement of SAB. After skin infiltration with lignocaine hydrochloride 2% in L3-L4 interspace, SAB was accomplished using 26-G Quincke's spinal needle. After confirmation of free flow of cerebrospinal fluid(CSF), a total of 2.2ml of drug comprising of 0.5 ml (25 microgram) of fentanyl with 1.7ml(8.5miligram) of hyperbaric bupivacaine was injected intrathecally and parturients were returned to supine position with 15 degree left lateral tilt .Oxygen was given through face mask at 4L/min. Highest level of sensory block was assessed using an ice cube at 1 min intervals till T4 level was attained. Surgery was commenced when level of T4-T6 was reached. If a level of T4 was not achieved, the patient was excluded from the study. NIBP, HR, SpO_2 and PI were recorded at 1 min interval till the delivery of baby. The time points of SAB administration, surgical incision and delivery of baby were recorded. Hypotension was defined as a decrease in systolic blood pressure to less than equal to 80% of baseline value which was treated with intravenous (iv) boluses of 6mg ephedrine.

Bradycardia (HR<60/min) associated with hypotension was treated with boluses of 6mg iv ephedrine and 0.6mg intravenous atropine and recorded. Rest of the intraoperative management and fluid replacement was as per the discretion of anaesthesiologist managing the case.

FOLLOWING OUTCOMES WERE OBSERVED:

PRIMARY OUTCOME

To evaluate the correlation of perfusion index and subarachnoid block induced hypotension in lower segment caesarean section, hence the following were observed after administration of SAB.

- Episodes of hypotension (SBP less than equal to 80% of baseline)
- Baseline and subsequent PI values at 1 min interval to delivery of baby

SECONDARY OUTCOME

- Total number of boluses of ephedrine used till the time of delivery.
- Incidence of intraoperative nausea, vomiting (IONV).
- Total Amount of crystalloid administered till the delivery of baby.
- Number of episodes of bradycardia needing intervention till delivery of baby.
- APGAR score at 1 minute and 5 minutes

Episodes of IONV were recorded using nausea vomiting score:

0: None.

1: Reported Nausea without vomiting.

2: Observed Vomiting.

IONV was treated with ivondansetron 4 mg.

Immediately after delivery APGAR score was assessed at 1 and 5 minutes, by an independent observer (Attending pediatrician blinded to the study group).

APGAR SCORE

It is an objective method of assessing the newborn condition.

SIGNS	0	1	2
Heart Rate	Absent	Slow Less than 100/min	Normal More than 100/min
Respiration	Absent	Weak cry	Good, strong cry
Muscle tone	Limp	Some flexion	Active movements
Reflex irritability	No response	Grimace	Cough or sneeze
Colour	Blue/pale	Body pink, extremities blue	Completely pink

A total of 7-10 score= normal

4-6 score= fairly low

Less than 3= critically low

STATISTICAL ANALYSIS

The statistical analysis was carried out using IBM SPSS (Statistical Package for Social Sciences) statistical version 20. The analysis include frequency table, bar, pie chart, association of variables based on Chi-square and risk ratio estimates with 95% Confidence Interval. All quantitative variables were estimated using measures of central location (mean and median) and measures of dispersion (standard deviation). Normality of data was checked by Kolmogorov Smirnov test. For normality distributed data, Mean was compared in with respect to parametric inference. For not normality distributed data, Median was compared using non parametric inference. All statistical tests were seen at two-tailed level of significance ($p \leq 0.01$ and $p \leq 0.05$).

SAMPLE SIZE

The overall rate of caesarean section delivery in 2015–16 is around 17.2% in India. [46-48]

The sampling technique used in the study was convenient sampling.

$n = (Z^2 \times P (1 – P))/E^2$

n=111 (approximately)

Where Z = value from standard normal distribution corresponding to desired confidence level

(Z=1.96 for 95% CI)

P (.17) is expected true proportion.

E (.07) is desired precision.

With these assumptions a sample size of 111 patients were included in the study. In addition, accounting for a 15% drop out rate we proposed a sample size of 120 patients for our study.

OBSERVATIONS AND RESULTS

The present observational study was conducted in a prospective manner in the department of Anaesthesiology, DMCH Ludhiana on a total of 120 parturients of more than 18 years of age belonging to ASA grade II who were scheduled for elective LSCS under SAB.

The study aimed to evaluate the correlation of perfusion index and subarachnoid block induced hypotension in lower segment caesarean section.

On arrival in the operating room, the baseline PI was noted and the mean of three consecutive SBP readings was taken as baseline value. All parturients received crystalloid co-load of 15ml/kg. The parturients were observed for episodes of hypotension and bradycardia until the delivery of baby.

The observations of our study are as follows:

TABLE 1: DEMOGRAPHIC PROFILE OF SUBJECTS INCLUDED IN THE STUDY

DEMOGRAPHIC PARAMETERS	Mean	SD
AGE(yrs)	29.32	4.76
HEIGHT(cm)	161.03	4.91
WEIGHT(kg)	72.96	7.25
BMI(kg/m^2)	28.07	2.45

Mean age of the patients was 29.32 ±4.76years, mean height was161.03±4.91, mean weight was 72.96±7.25 and mean BMI was 28.07±2.45 kg/m^2.

TABLE 2: THE MEAN OF BASELINE VITAL PARAMETERS

BASELINE VITAL PARAMETERS	Mean	SD
PI	3.79	1.79
SBP(mmHg)	129.68	7.97
DBP(mmHg)	80.84	8.77
MAP(mmHg)	97.10	7.15
HR(bpm)	88.91	10.69
SpO_2 (%)	98.74	0.63

The mean baseline PI was 3.79±1.79, SBP was 129.68 ±7.97 mmHg, DBP was 80.84±8.77 mmHg, MAP was 97.10±7.15mmHg, HR was 88.91±10.69bpm and SpO_2 was 98.74±0.63%.

TABLE 3: INCIDENCE OF HYPOTENSION

HYPOTENSION(SBP DECREASE TO ≤ 80% OF BASELINE)	No. of cases	Percentage
NO	77	64.2%
YES	43	35.8%
NO. OF EPISODES		
1	13	10.8%
2	21	17.5%
3	7	5.8%
4	1	0.8%
5	1	0.8%

Hypotension was observed in 43 out of 120 patients (35.8%). Out of 43 patients, 13 patients had only one episode of hypotension, 21 patients had two episodes, 7 patients had three episodes, 1 patient had four episodes and only one patient had five episodes.

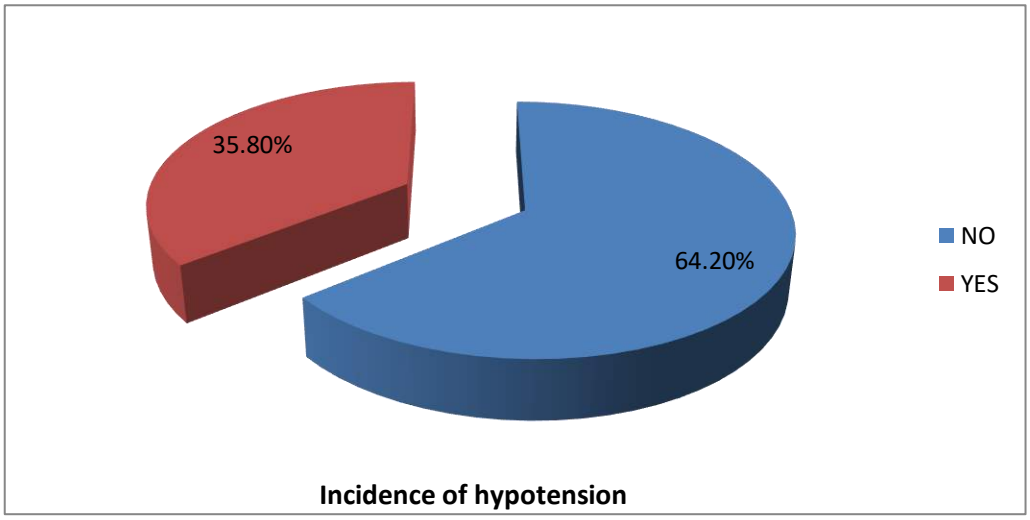

FIGURE 1: INCIDENCE OF HYPOTENSION

TABLE 4: DOSE OF IV EPHEDRINE (MG) ADMINISTERED IN PARTURIENTS EXPERIENCING HYPOTENSION

Dose Of Ephedrine (Mg) Administered	No. of cases	Percentage
	77	64.2%
6mg	13	10.80%
12mg	21	17.50%
18mg	7	5.80%
24mg	1	0.80%
30mg	1	0.80%

Out of 43 patients, 13 patients received 6mg ephedrine, 21 patients received 12mg ephedrine, 7 patients received 18mg ephedrine, 1 patient received 24mg ephedrine and one patient received 30mg ephedrine.

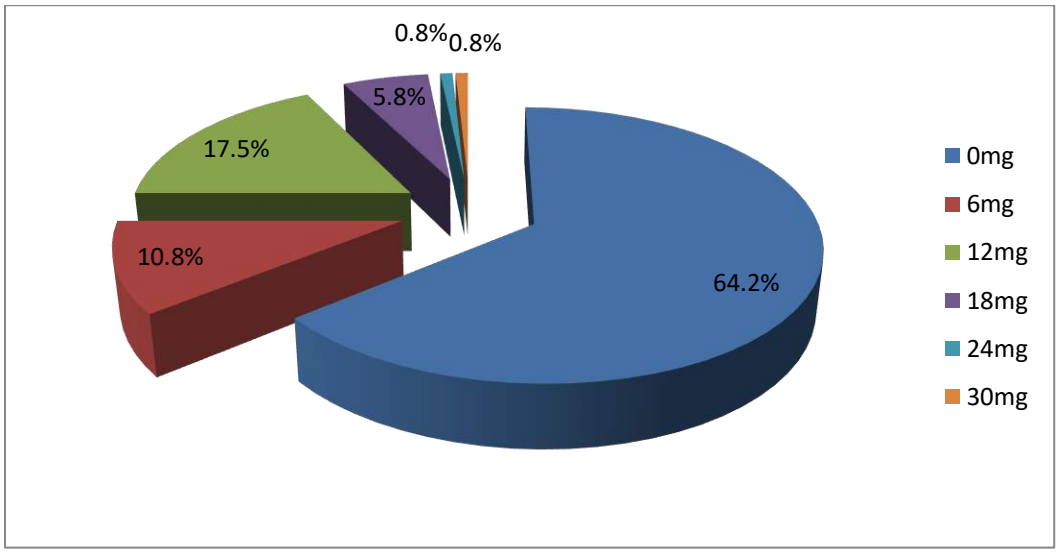

FIGURE 2: DOSE OF IV EPHEDRINE (MG) ADMINISTERED IN PARTURIENTS EXPERIENCING HYPOTENSION

TABLE 5: INCIDENCE OF BRADYCARDIA AND TREATMENT GIVEN

Bradycardia (< 60 per min)	No. Of cases	Percentage	Dose of atropine(mg) administered)
Yes	2	1.7%	0.6
NO	118	98.3%	0

Bradycardia was observed in 2 out of 120 patients (1.7%). Atropine (0.6mg) was administered as a rescue treatment in both the cases.

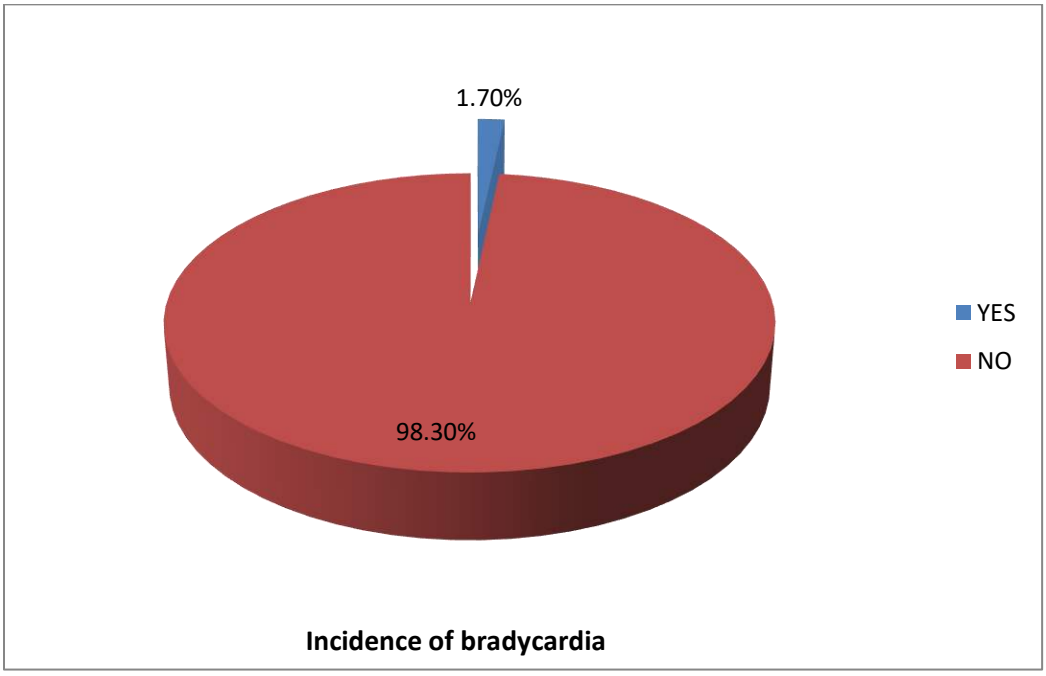

FIGURE 3: INCIDENCE OF BRADYCARDIA AND TREATMENT GIVEN

TABLE 6: INCIDENCE AND GRADING OF IONV

EPISODES OF IONV	No. of cases	Percentage
0	84	70.0%
1	36	30.0%
GRADING		
0	84	70.0%
1	26	21.7%
2	10	8.3%

The total incidence of IONV was 30%. Out of which 21.7% parturients had grade 1 IONV (nausea) and 8.3% parturients had grade 2 IONV (vomiting).

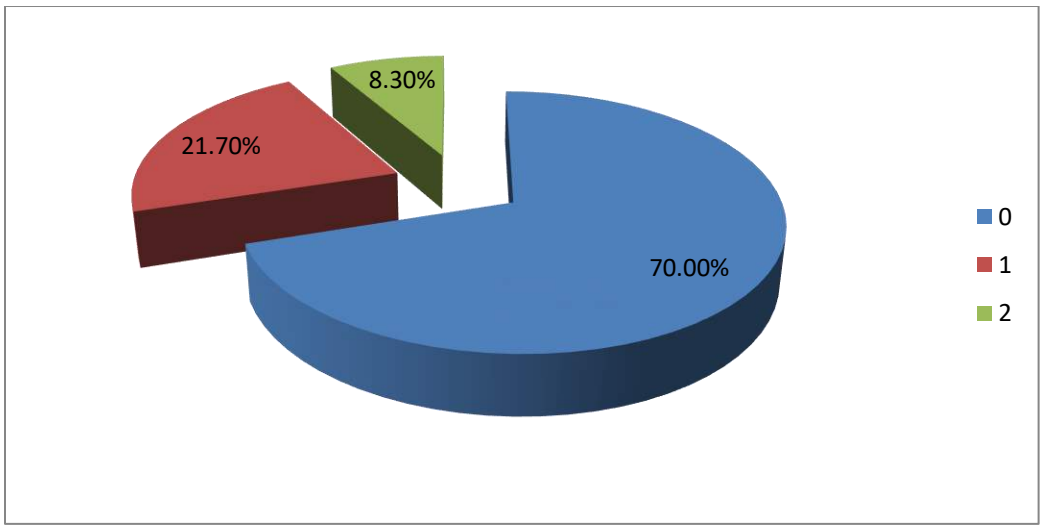

FIGURE 4: INCIDENCE AND GRADING OF IONV

TABLE 7: INTERVENTION FOR IONV (DOSE OF ONDANSETRON (MG) GIVEN)

INTERVENTION (DOSE OF ONDANSETRON(mg)) ADMINISTERED	No. of cases	Percentage
0	84	70.0%
4	36	30.0%

Out of 120, thirty six parturients received 4 mg ondansetron for each episode of IONV.

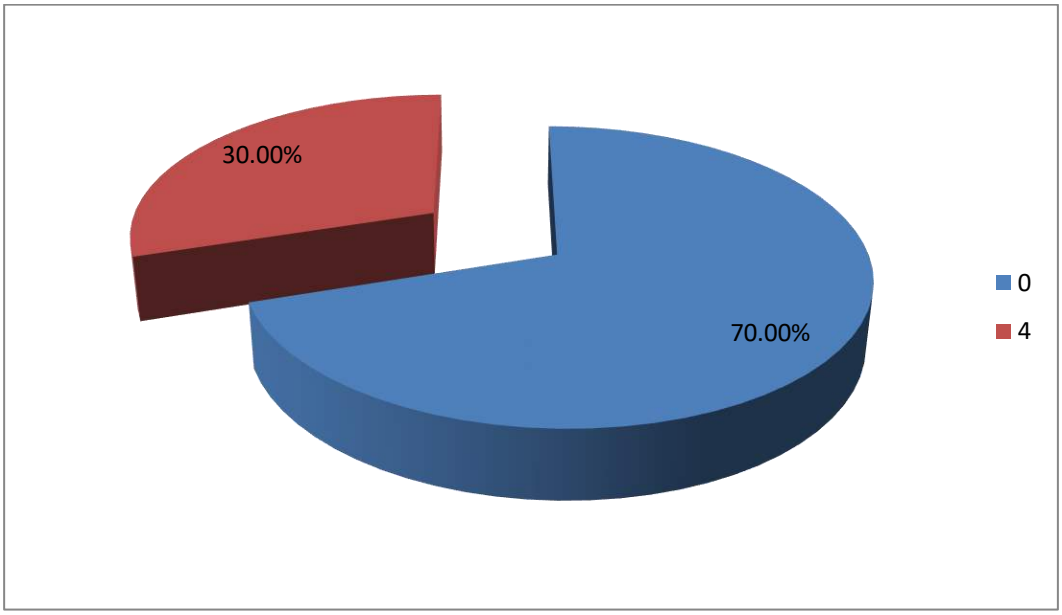

FIGURE 5: INTERVENTION FOR IONV (DOSE OF ONDANSETRON (MG) GIVEN)

TABLE 8: THE CORRELATION BETWEEN BASELINE PI AND DEGREE OF DECREASE IN SBP

Correlation	mean PI	
SBP decrease %	Pearson Correlation(r)	0.552
	p-value	0.001

The correlation between baseline PI and the degree of decrease in SBP during spinal anaesthesia for Caesarean delivery [%SBP decrease= (baseline SBP–lowest SBP)/baseline SBP]
(r=0.552, P <0.001).

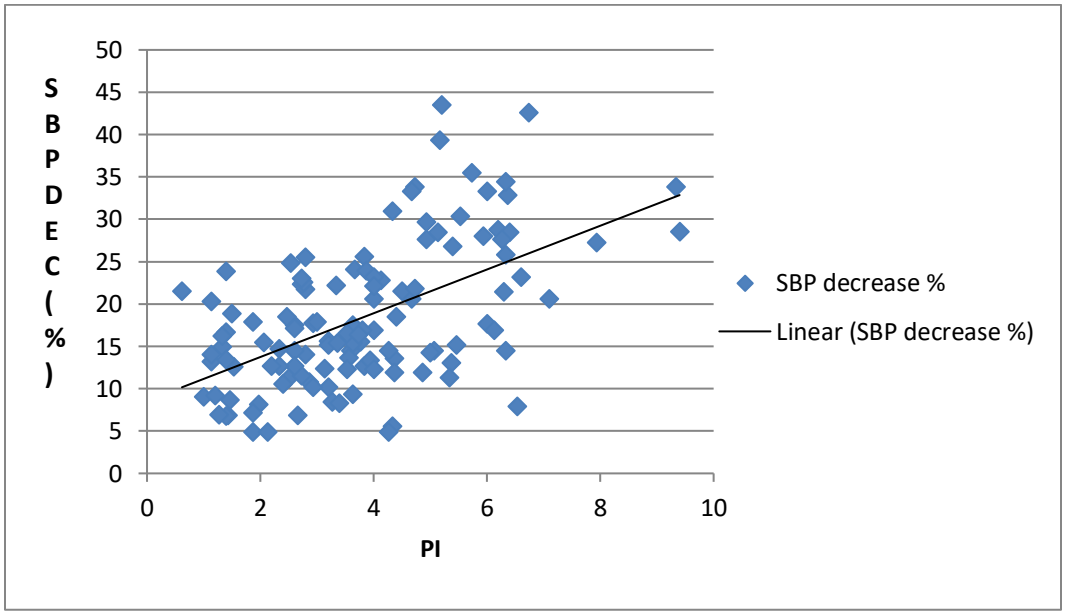

FIGURE 6: THE CORRELATION BETWEEN BASELINE PI AND DEGREE OF DECREASE IN SBP.

The solid line represents the linear regression line and the dots represent the 95% CIs.

TABLE 9: AREA UNDER THE ROC CURVE FOR THE MEAN PI

Test Result Variable: mean PI

Area	Std. Error[a]	p-value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.798	0.043	0.000	0.715	0.882

The ROC analysis revealed that baseline PI was suitable for detecting parturients at risk of hypotension (AUC= 0.798). The baseline PI cut-off point that predicted hypotension as determined by the ROC analysis was 3.82 with a sensitivity of 79.07% (95% confidence interval), a specificity of 72.73% (95% confidence interval), a positive predictive value of 61.82% and a negative predictive value of 86.15% (p value<0.001).

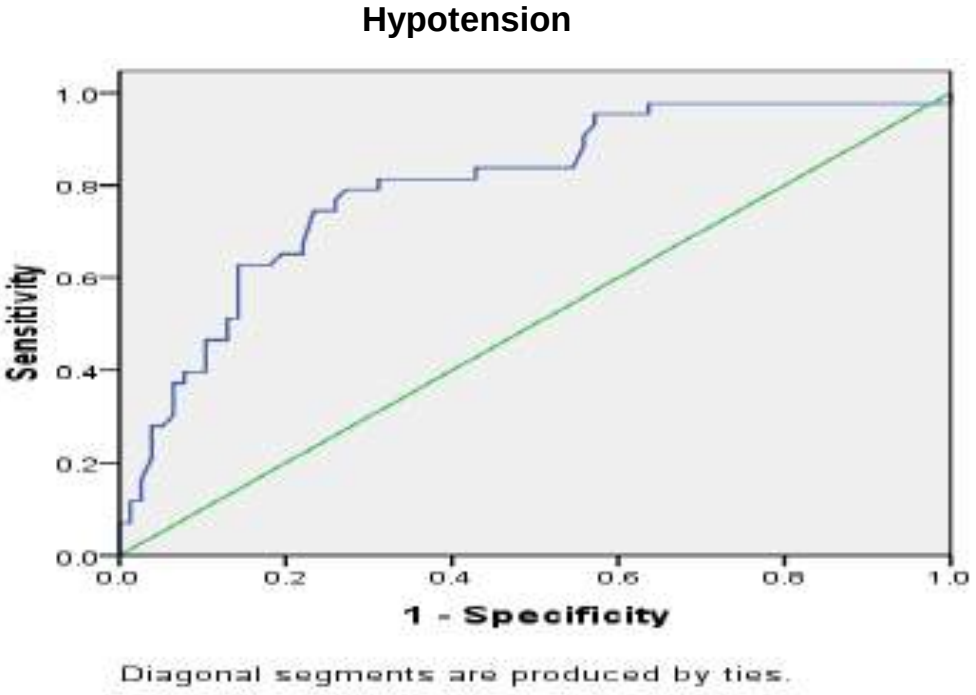

FIGURE 6: THE CORRELATION BETWEEN BASELINE PI AND DEGREE OF DECREASE IN SBP

TABLE 10: ASSOCIATION OF HYPOTENSION WITH PI

		HYPOTENSION				Total	Chi square value	p-value
		N		Y				
PI	< 3.82	56	72.7%	9	20.9%	65	29.817	0.0001
	> 3.82	21	27.3%	34	79.1%	55		
Total		77	100.0%	43	100.0 %	120		

Sixty five parturients had low baseline PI (PI<3.82) and hypotension was observed in nine of those parturients (20.9%), whereas fifty five parturients had high baseline PI (PI>3.82) and hypotension observed in thirty four of those parturients (79.1%). A significant correlation was found between hypotension and PI (p-value-0.0001).

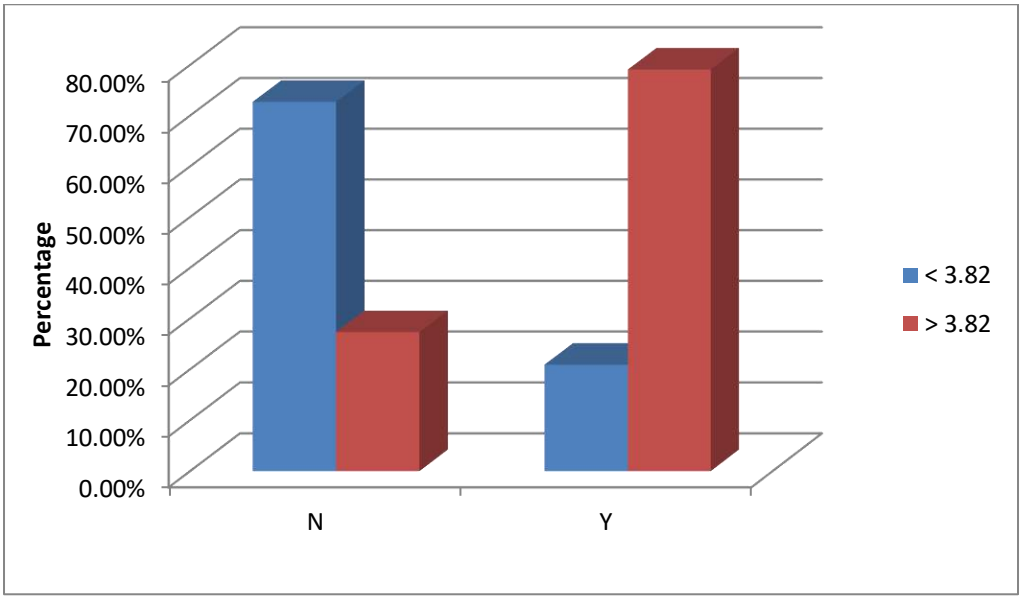

FIGURE 8: ASSOCIATION OF HYPOTENSION WITH PI

TABLE 11: CORRELATION BETWEEN PI AND DOSE OF EPHEDRINE ADMINISTERED FOR HYPOTENSION

		PI				Total	Chi square value	p-value
		< 3.82		> 3.82				
DOSE OF EPHEDRINE (MG) ADMINISTERED	0	56	86.2%	21	38.2%	77	30.226	0.0001
	6	3	4.6%	11	20.0%	14		
	12	4	6.2%	15	27.3%	19		
	18	2	3.1%	6	10.9%	8		
	24	0	0.0%	1	1.8%	1		
	30	0	0.0%	1	1.8%	1		

The dose of ephedrine administered for treatment of hypotension was significantly higher in parturients with high baseline PI(> 3.82) than low baseline PI(<3.82). (p<0.0001) (r=0.452)

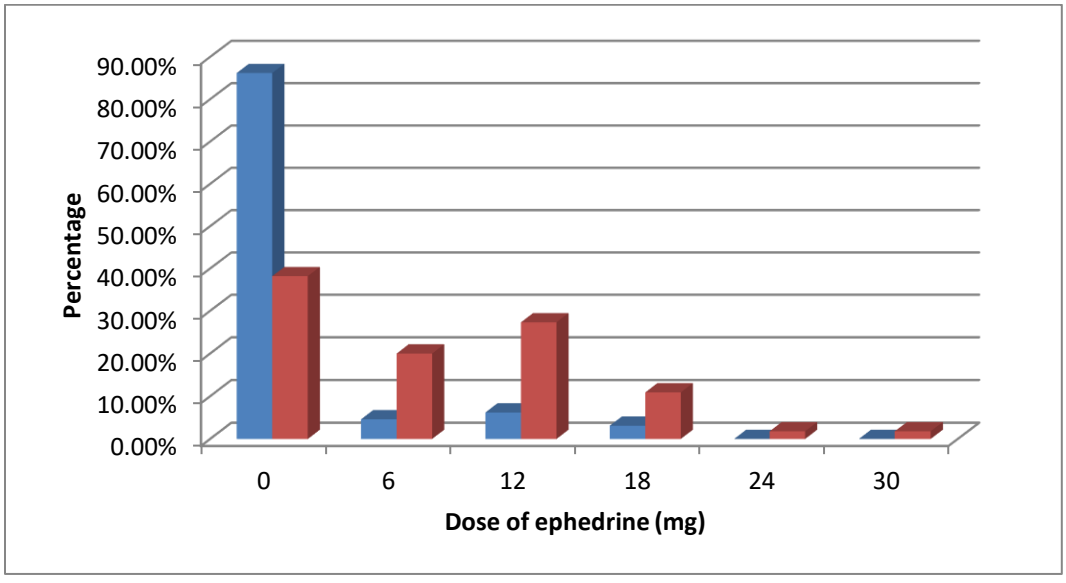

FIGURE 9: CORRELATION BETWEEN PI AND DOSE OF EPHEDRINE ADMINISTERED FOR HYPOTENSION

TABLE 12: CORRELATION BETWEEN PI AND AMOUNT OF CRYSTALLOID (ML) GIVEN

PI	< 3.82		> 3.82		Z	p-value
	Median	IQR	Median	IQR		
AMOUNTOF CRYSTALLOID (ML) USED	1100	1000-1200	1000	1000-1200	-0.110	0.913

No significant difference was found in the amount of crystalloid used for co-loading in parturients with low baseline PI (<3.82) and high baseline PI (>3.82). (P<0.913, r=0.192)

TABLE 13: CORRELATION BETWEEN PI AND INCIDENCE OF IONV

		PI				Total	Chisqurae value	p-value
		< 3.82		> 3.82				
EPISODES OF IONV	0	59	90.8%	25	45.5%	84	29.131	0.0001
	1	6	9.2%	30	54.5%	36		
GRADING	0	59	90.8%	25	45.5%	84	29.379	0.0001
	1	5	7.7%	21	38.2%	26		
	2	1	1.5%	9	16.4%	10		

Incidence of IONV was significantly higher in parturients with high baseline PI (>3.82) than low baseline PI (>3.82) (p <0.0001).

TABLE 14: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE SYSTOLIC BLOOD PRESSURE (SBP) (MMHG) AND ASSOCIATION WITH PI

PI	< 3.82		> 3.82		T	p-value
	Mean	SD	Mean	SD		
SBP AT 1 MIN	129.57	8.62	126.11	12.29	1.806	0.074
SBP AT 2 MIN	119.42	8.97	112.89	13.41	3.174	0.002
SBP AT 3 MIN	116.26	9.04	105.02	14.56	5.161	0.001
SBP AT 4 MIN	116.37	7.54	108.36	13.35	4.121	0.001
SBP AT 5 MIN	118.46	8.11	113.11	11.74	2.940	0.004
SBP AT 6 MIN	121.16	6.91	118.58	9.92	1.641	0.104
SBP AT 7MIN	124.02	9.46	120.58	6.36	2.102	0.038
SBP AT 8 MIN	123.87	7.62	123.18	7.75	0.414	0.680
SBP AT 9 MIN	125.00	8.20	123.86	6.79	0.638	0.525
SBP AT 10 MIN	123.71	6.73	125.52	5.65	-0.943	0.351
SBP AT 11 MIN	123.29	6.87	126.20	6.14	-1.070	0.296
SBP AT 12 MIN	123.60	5.37	124.75	5.12	-0.326	0.754

The SBP decreased after spinal injection in parturients with both high and low baseline PI. Parturients with high baseline PI (PI>3.82) had significant decrease in SBP at 2,3,4,5 and 7 min after spinal injection than those with low baseline PI(PI<3.82) (P=0.002, 0.001,0.001 and 0.004, respectively).

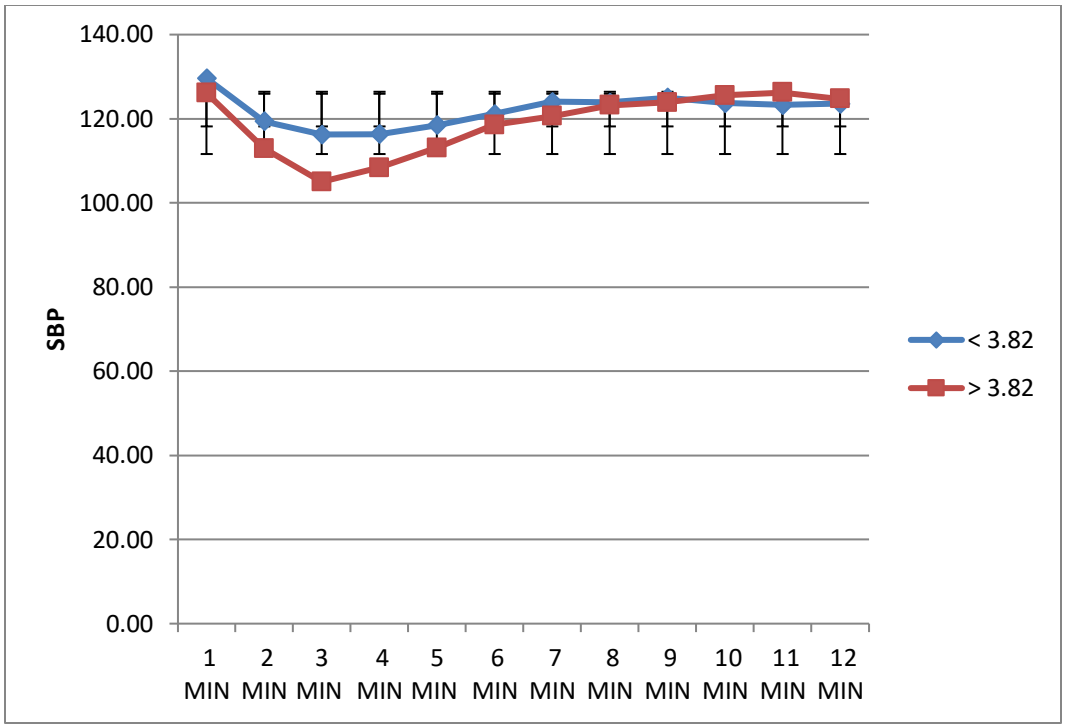

FIGURE 10: TRENDS OF MEAN VALUES OF INTRAOPERATIVE SYSTOLIC BLOOD PRESSURE (SBP) (MMHG) AND ASSOCIATION WITH PI

TABLE 15: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE DIASTOLIC BLOOD PRESSURE (DBP) (MMHG) AND ASSOCIATION WITH PI

PI	< 3.82		> 3.82		t	p-value
	Mean	SD	Mean	SD		
DBP AT 1 MIN	77.83	9.08	75.02	11.04	1.531	0.128
DBP AT 2 MIN	70.65	9.31	66.22	12.59	2.211	0.029
DBP AT 3 MIN	66.32	8.56	60.64	12.92	2.879	0.005
DBP AT 4 MIN	65.89	7.80	62.20	10.18	2.248	0.026
DBP AT 5 MIN	68.23	7.28	64.93	9.22	2.193	0.030
DBP AT 6 MIN	69.48	8.37	67.26	7.96	1.450	0.150
DBP AT 7 MIN	70.68	7.39	67.94	6.74	1.917	0.058
DBP AT 8 MIN	69.93	8.77	69.83	7.38	0.061	0.951
DBP AT 9 MIN	71.49	7.52	71.44	6.74	0.024	0.981
DBP AT 10 MIN	70.10	7.20	69.09	5.34	0.522	0.605
DBP AT 11 MIN	71.00	8.80	73.20	5.98	-0.684	0.501
DBP AT 12 MIN	64.40	3.85	74.40	4.56	-3.748	0.006

The DBP decreased after spinal injection in parturients with both high and low baseline PI, parturients with high baseline PI (PI>3.82) had larger decrease in DBP at 2, 3,4 and 5min after spinal injection than those with low baseline PI(PI<3.82) but the difference was not statistically significant at any of the time intervals.

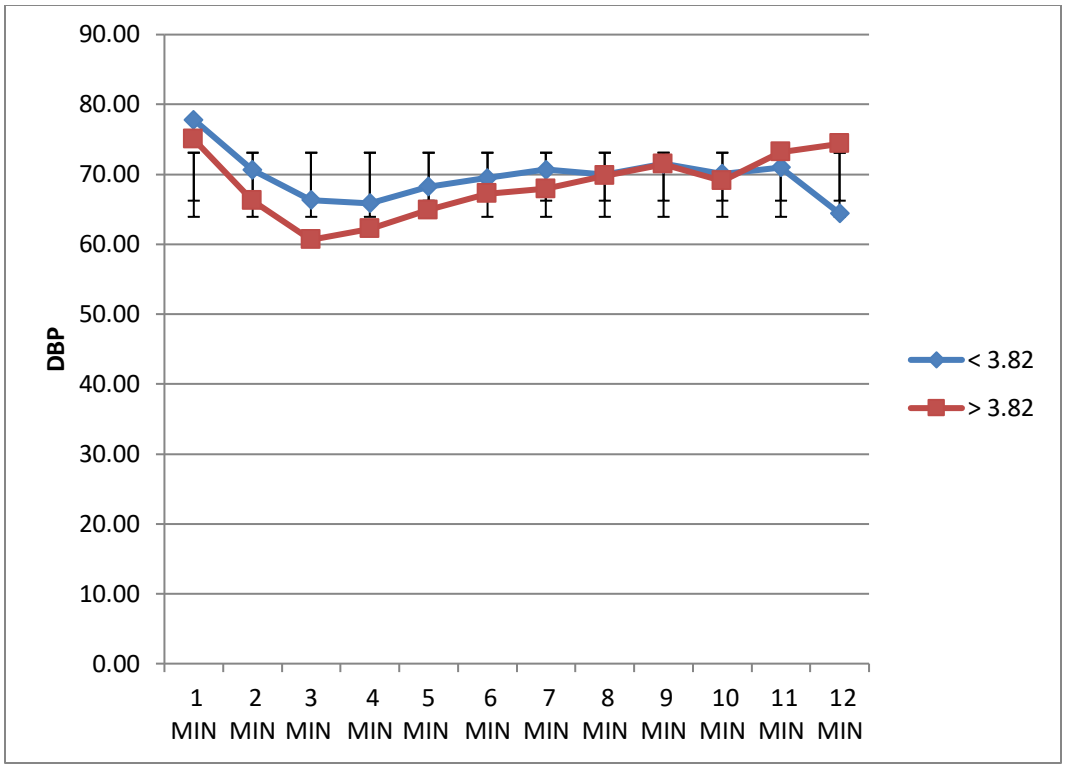

FIGURE 11: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE DIASTOLIC BLOOD PRESSURE (DBP) (MMHG) AND ASSOCIATION WITH PI

TABLE 16: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE MEAN ARTERIAL PRESSURE (MAP) (MMHG) AND ASSOCIATION WITH PI

PI	< 3.82		> 3.82		t	p-value
	Mean	SD	Mean	SD		
MAP AT 1 MIN	95.08	7.75	92.05	9.78	1.891	0.061
MAP AT 2 MIN	86.90	7.96	81.78	11.80	2.825	0.006
MAP AT 3 MIN	82.97	7.88	75.43	12.92	3.922	0.001
MAP AT 4 MIN	82.72	6.89	77.59	10.58	3.190	0.002
MAP AT 5 MIN	84.97	6.69	80.99	9.42	2.702	0.008
MAP AT 6 MIN	86.70	7.01	84.37	7.88	1.688	0.094
MAP AT 7 MIN	88.46	7.47	85.49	5.46	2.242	0.027
MAP AT 8 MIN	87.91	7.73	87.61	6.81	0.191	0.849
MAP AT 9 MIN	89.32	7.14	88.92	6.10	0.259	0.797
MAP AT 10 MIN	87.97	6.34	86.00	10.03	0.765	0.449
MAP AT 11 MIN	88.43	7.28	90.87	4.75	-0.925	0.365
MAP AT 12 MIN	84.13	2.51	82.87	15.87	0.176	0.864

There was marked decrease in MAP after spinal injection in parturients with both high and low baseline PI. Parturients with high baseline PI (PI>3.82) had significant decrease in MAP at 2, 3, 4, 5 and 7 min after spinal injection than those with low baseline PI (PI<3.82) (P=0.001 and 0.002, respectively).

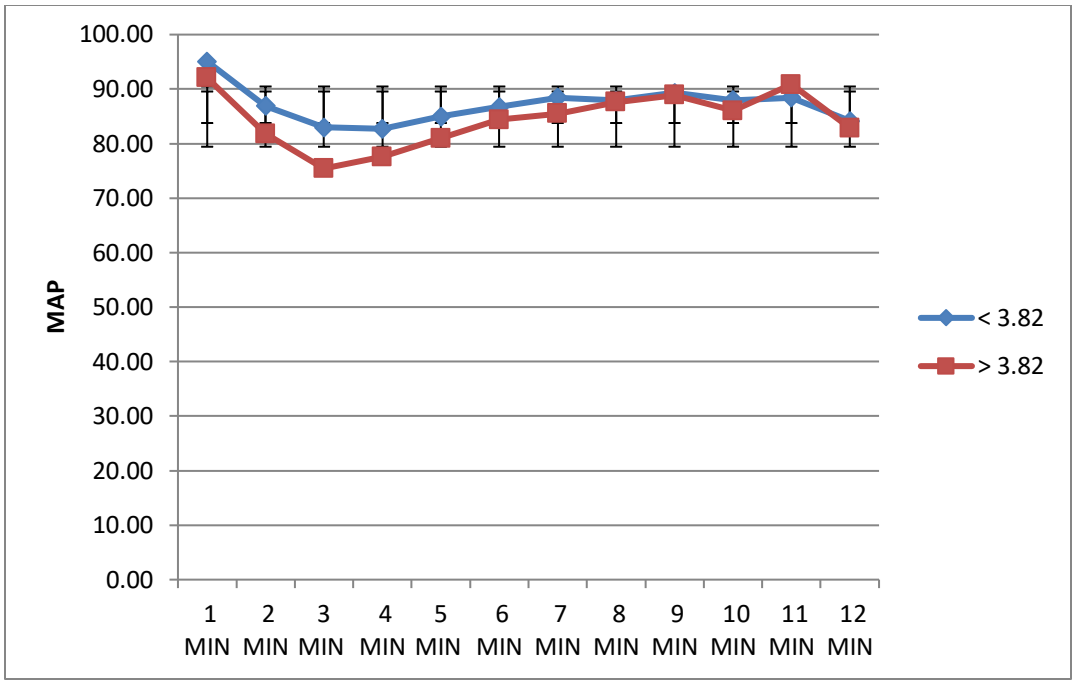

FIGURE 12: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE MEAN ARTERIAL PRESSURE (MAP) (MMHG) AND ASSOCIATION WITH PI

TABLE 17: TRENDS OF MEAN VALUES OF INTRA-OPERATIVE HEART RATE (HR) (BPM) AND ASSOCIATION WITH PI

PI	< 3.82		> 3.82		t	p-value
	Mean	SD	Mean	SD		
HR AT 1 MIN	91.55	10.03	91.98	11.56	-0.217	0.828
HR AT 2 MIN	91.32	11.04	92.27	13.13	-0.431	0.668
HR AT 3 MIN	89.38	10.82	89.33	14.24	0.025	0.980
HR AT 4 MIN	87.38	9.60	88.11	13.60	-0.341	0.734
HR AT 5 MIN	87.42	8.84	87.29	12.11	0.065	0.948
HR AT 6 MIN	87.82	8.56	85.35	19.39	0.911	0.364
HR AT 7 MIN	86.64	8.80	86.81	11.46	-0.084	0.933
HR AT 8 MIN	86.30	8.50	86.98	11.43	-0.311	0.757
HR AT 9 MIN	85.94	7.75	85.86	10.74	0.036	0.972
HR AT 10 MIN	82.75	13.13	81.59	11.90	0.300	0.766
HR AT 11 MIN	86.23	7.25	82.40	12.89	0.905	0.376
HR AT 12 MIN	88.80	7.16	85.40	14.14	0.480	0.644

No significant difference was found between HR in parturients with high baseline PI (PI>3.82) and those with low baseline PI (<3.82).

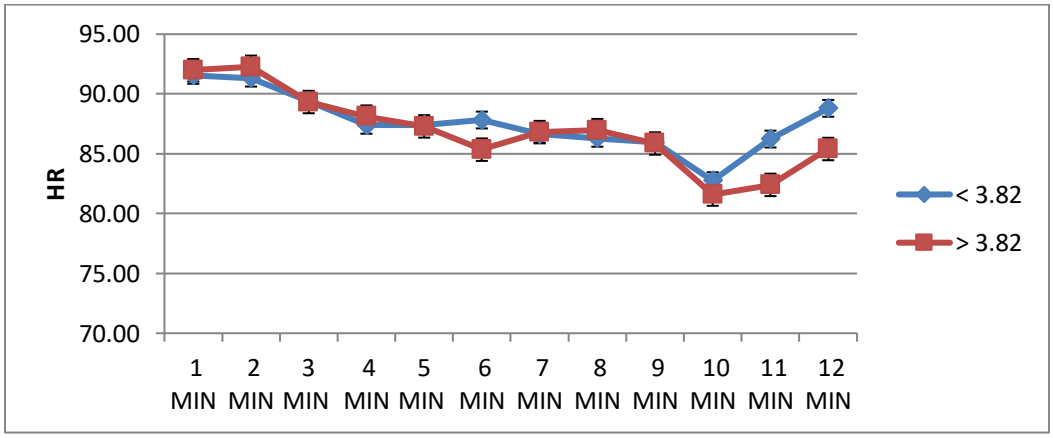

FIGURE 13: TRENDS OF MEAN VALUES OF INTRAOPERATIVE HEART RATE (HR) (BPM) AND ASSOCIATION WITH PI

TABLE 18: CORRELATION BETWEEN PI AND NEONATAL OUTCOME (APGAR SCORE)

APGAR SCORE AT 1 MIN	Pearson Correlation	-0.142	-0.147
	p-value	0.121	0.108
	N	120	120
APGAR SCORE AT 5 MIN	Pearson Correlation	-0.082	-0.153
	p-value	0.375	0.095
	N	120	120

Neonatal outcomes did not differ between parturients

With high baseline PI (PI>3.82) and those with low baseline PI (PI<3.82).

DISCUSSION

SAB induced hypotension is mainly a result of decreased systemic vascular resistance due to blockade of pre-ganglionic sympathetic fibres. This induces pooling of blood in blocked areas of the body, leading to reductions in cardiac output and MAP. [6] Maternal hypotension is a physiological consequence of SAB during lower segment cesarean section contributing to adverse maternal and fetal outcomes. [4,5,7] It is critically important to identify the patients at risk of developing hypotension, thus, giving the anaesthetist an opportunity to prevent this by ensuring good volume status and using prophylactic vasopressors if needed. Many parameters have been studied for prediction of hypotension in subarachnoid block. Some of them are advanced age, baseline heart rate (HR), heart rate variability (HRV), body mass index (BMI), preoperative anxiety. [10-18] Preoperative sympathetic activity, peripheral vascular tone and preoperative volume status are known to affect the degree of hypotension. [11] Several studies using plethysmography have demonstrated a reduction in peripheral vascular tone as a cause of hypotension. But the technique is invasive and not very feasible in the elective settings. In contrast, non-invasive plethysmographic pulse wave monitoring available in most pulse oximeters can be used routinely. [3,8,27] Perfusion index (PI) has shown promising results in effectively assessing peripheral perfusion dynamics and vascular tone. [3]

PI is the ratio of the pulsatile component (arterial) and non pulsatile component of light reaching the detector. The principle of SpO_2 is based on two light sources with different wavelengths; 660 nm and 940 nm, emitted through cutaneous vascular bed of finger or earlobe. The absorbance of both wavelengths has a pulsatile component, which represents fluctuations in the volume of arterial blood between the source and the detector. The non pulsatile component is from connective tissue, bone and venous compartment.

The reliability of PI to detect vasoconstriction has been demonstrated and proved by Mowafi et al using epidural test dose containing intravascular injection of epinephrine.[44] Ginosar et al showed PI to be a sensitive indicator of the development of epidural – induced sympathectomy than either skin temperature or MAP in patients undergoing lithotripsy. [28]

Peripheral vascular tone has been shown to be decreased in parturients at term. [6-8] There have been few studies evaluating the role of PI using pulse oximeter to predict hypotension following spinal anaesthesia in parturients undergoing cesarean section. It has been seen that decrease in tone corresponds to higher PI values. This is due to the increase in pulsatile component associated with vasodilation. Parturients with higher baseline PI have lower peripheral vascular tone and hence are at a higher risk of developing hypotension following spinal anaesthesia. [1-3,8,19-21] We therefore chose to study the role of baseline PI to predict hypotension in parturients undergoing LSCS under SAB and thereby evaluating the effect of hypotension on IONV and APGAR score.

In our study, the total incidence of hypotension was 35.8% (43/120). Out of 43 parturients, 9 (20.9%) had PI<3.82 and 34 (79.1%) had PI>3.82. Hence, the incidence was significantly higher in parturients with high PI(>3.82) as compared to parturients with low PI (<3.82). Our findings are in concordance with the prospective observational studies done by Patel et al [2] and Pradhan AP et al [1], who also demonstrated that the incidence of hypotension is more in higher PI groups but the cut off values taken in their study were 4.05 and 3.5 respectively. Patel et al included fifty two patients undergoing elective LSCS under spinal anaesthesia for the study and divided them into groups with PI < 4.0 and PI >4.0. Results were analyzed using Chi-square test, Spearman's coefficient of correlation and Receiver Operating Characteristic Curve (ROC). The incidence of hypotension was 91.6% in patients with PI >4 as compared to 16.6% in patients with PI <4 ($p<0.001$). There was a significant correlation between

the baseline PI, incidence of hypotension, fluid boluses and dose of mephentermine administered (p<0.001). [2] Pradhan et al included total 106 cases in their study, 52 were in low PI group and 54 cases in high PI group respectively. Haemodynamic effects and PI values were monitored, recorded and compared between low and high PI groups. The incidence of hypotension was found to be 26% in low PI group whereas it was 48% in high PI group. [1] The incidence of hypotension found in a study by Duggapa et al was 10.5% (6/57) in PI group <3.5 as compared to 71.42% (45/63) in PI group>3.5. [20]

In a study conducted by Toyoma et al, 35 parturients were enrolled and the incidence of hypotension in PI<3.5 parturients was 25% as compared to 82% in PI>3.5 parturients. Varghese et al also reported a fall in BP after administration of SAB which was more in higher PI group (6.67% vs 86.67% in low vs high PI group). But the incidence seen in these studies was higher in comparison to that seen in our study. This could be explained by the higher dose of intrathecal hyperbaric bupivacaine used in their study (10 milligram of 0.5% hyperbaric bupivacaine) compared to our study (8.5 milligram of 0.5% hyperbaric bupivacaine with 25 microgram of fentanyl). [19,20]

Findings similar to our study have also been reported by George J et al [3] and Mallawaarachchi et al [8] who found fair correlation between higher baseline PI and the number of episodes of hypotension.

In our study, for each episode of hypotension, 6mg of intravenous Ephedrine was administered. The dose of Ephedrine administered was significantly higher in parturients with PI> 3.82 than PI<3.82. (p<0.001) (r=0.452)

The amount of vasopressor used was significantly higher in parturients with PI>3.5 in study by Toyama et al. Although, they used combined spinal epidural (CSE) technique and for each episode of hypotension,

phenylepherine was used as a rescue vasopressor. [19] In the study conducted by Patel et al [2] and Duggappa et al [20], the amount of vasopressor used was found to be significantly higher in high PI group and findings were similar to our study .But they also used 100 ml Ringer lactate to treat an episode of hypotension. No fluid bolus was given to treat the episode of hypotension in our study.

In our study, after regression analysis and ROC curve analysis the baseline PI cut off point that predicted hypotension following spinal anaesthesia was 3.82 with a sensitivity of 79.07% and a specificity of 72.73%. A highly significant correlation was seen between baseline PI and degree of decrease in systolic arterial pressure ($r=0.552$, $p<0.001$) as shown by greater hypotension in patients with PI >3.82. The area under the ROC curve for PI to predict hypotension was 0.798. Our findings are in concordance with the study conducted by Toyoma et al. They found a highly significant correlation between baseline PI>3.5 and the degree of decrease in systolic and mean arterial pressure. ($r=0.664$, $p<0.0001$ and $r=0.491$, $p=0.0029$, respectively) with sensitivity of 81%, specificity of 86%.[19] In the studies conducted by Varghese et al [21] and Duggappa et al[20], significant correlation was seen with baseline PI >3.5 and incidence of hyotension, with a sensitivity of 86.67%, 69.84% respectively and specificity of 93.33%, 89.29% respectively. Similar findings were seen in a study conducted by George J et al. They had taken baseline PI cutoff as 3.6 with a sensitivity of 80% and specificity of 60% for prediction of hypotension. [3]

In contrast, a recent study performed by Arslan et al, demonstrated that PI has a weak predictive value for postspinal hypotension. [49] Yokose et al also demonstrated that PI has no predictive value for hypotension in parturients undergoing LSCS following SAB. [13] This difference can attributed to various methodological differences, such as the definition of hypotension (we used a fall of >20% of the baseline SBP to define

hypotension compared to their study where they defined hypotension as SBP of <80mmHg) and method of calculation of baseline PI.

In our study, 2 out of 55 parturients with baseline PI>3.82 had episode of bradycardia. None of the parturients with PI <3.82 developed bradycardia. On comparison; the difference in the incidence of bradycardia was not significant. Previous Studies by Duggappa et al [20] and Toyoma et al [19] have also reported similar findings. They found no significant difference in the incidence of bradycardia among low and high PI groups.

Improved haemodynamic control results in lower incidence of IONV. It has been suggested that following spinal anaesthesia, hypotension leads to a decrease in cerebral perfusion with brainstem ischaemia and activation of the vomiting centre along with the release of emetogenic substances like serotonin due to gut hypoperfusion.

In our study, 30 parturients had IONV with PI>3.82 as compared to 6 parturients with PI<3.82.). Both the incidence and grading of IONV was found to be significantly higher in parturients with PI>3.82, thus showing a fair correlation between incidence of IONV and higher baseline PI. For each episode of IONV 4 mg IV ondansetron was administered. On the other hand, study conducted by Duggappa et al [20] and Pradhan AP [1] et al found no significant correlation between incidence of IONV and PI in both the groups.

In our study the amount of crystalloid co-loading was fixed at the rate of 15 ml/kg, which was administered till the delivery of baby. There was no significant difference in the amount of fluid administered in all parturients irrespective of their PI values. Hence volume status did not effect the degree of hypotension, thus validating the correlation of hypotension with PI.

We observed comparable and favorable neonatal outcomes reflected clinically in good overall APGAR score. APGAR score, did not differ

between parturients with high baseline PI (PI>3.82) and those with low baseline PI (PI<3.82).

There are many limitations of our study. In our study, we have compared PI with non-invasive blood pressure which can measure blood pressure only with a time lag. For more accuracy, PI should have been compared with invasive arterial blood pressure. However use of arterial cannulation for elective caesarean section was not deemed to be appropriate. Baseline PI, heart rate and blood pressure were taken with patient in supine position but after administering spinal anaesthesia a left tilt was given, which reduces aortocaval compression and this might have interfered with results. Patient anxiety, temperature and movement at the measuring site can also affect the measurements. However we recorded baseline PI values with utmost care to avoid any errors.

We used ephedrine as a first line vasopressor to manage spinal anaesthesia induced hypotension. As suggested from this study low baseline vascular tone is a major cause responsible for spinal induced hypotension during caesarean deliveries. Use of phenylephrine which increases the vascular tone could have been a more practical choice of vasopressor in our study.

The overall results of our study indicate that higher baseline PI values are associated with more incidence of hypotension. PI is a simple, safe and an easy method to predict hypotension intra-operatively. We suggest further studies to be carried out before PI can be finally used as a universal non invasive tool for predicting hypotension after subarachnoid block.

SUMMARY AND CONCLUSION

The present study was conducted in the department of Anaesthesia, Dayanand Medical College and Hospital, Ludhiana after approval from Institutional Ethics Committee. One hundred and twenty ASA II parturients of age more than 18 years, undergoing lower segment caesarean section (LSCS) under subarachnoid block (SAB) were enrolled for this prospective observational study.

The anaesthetic technique was standardized in all the parturients. On arrival in the operating room, the baseline PI was noted on the right index finger using pulse oximeter probe. The mean of three consecutive readings of systolic blood pressure (SBP) at 1 min interval was taken as the baseline value. Parturients were administered SAB in sitting or lateral position using full aseptic precautions. All parturients received crystalloid co-load of 15ml/kg via a pressurised set to administer the fluid at the maximum possible rate while placement of SAB. After skin infiltration with lignocaine hydrochloride 2% in L3-L4 interspace, SAB was accomplished using 26-G Quincke's spinal needle. After confirmation of free flow of cerebrospinal fluid (CSF), a total of 2.2ml of drug comprising of 0.5 ml (25 microgram) of fentanyl with 1.7ml (8.5miligram) of hyperbaric bupivacaine was injected intrathecally and parturients were returned to supine position with 15 degree left lateral tilt . NIBP, HR, SpO_2 and PI were recorded at 1 min interval till the delivery of baby. The incidence of hypotension and the correlation between perfusion index and subarachnoid block induced hypotension was calculated. Total number of boluses of ephedrine used, incidence of intraoperative nausea, vomiting (IONV), total amount of crystalloid administered, number of episodes of bradycardia needing intervention till delivery of baby and APGAR score at 1 minute and 5 minutes were also recorded.

The following conclusions were drawn during the study period:

- The patients in all the groups were comparable with respect to age, weight, height and ASA physical status.
- The mean baseline parameters were comparable among all the patients.
- The incidence of hypotension was 35.8% and of bradycardia was 1.7%.
- The total incidence of IONV was found to be 30%.
- Significant correlation was observed between baseline PI and the degree of hypotension after spinal anaesthesia for Caesarean delivery [%SBP decrease= (baseline SBP–lowest SBP)/baseline SBP] with $r=0.552$, $p<0.001$.
- The ROC analysis revealed that baseline PI was suitable for detecting parturients at risk of hypotension (AUC= 0.798). The baseline PI cut-off point that predicted hypotension as determined by the ROC analysis was 3.82 with a sensitivity of 79.07% (95% confidence interval), a specificity of 72.73% (95% confidence interval), a positive predictive value of 61.82% and a negative predictive value of 86.15% (p value<0.001).
- The incidence of hypotension was significantly higher in high baseline (>3.82) PI group (79.1%) than low baseline (<3.82) PI group (20.9%).
- The total dose of ephedrine administered for treatment of hypotension was significantly higher in high baseline (>3.82) PI group than low baseline (<3.82) PI group ($p<0.0001$) ($r=0.452$).
- No significant difference was found in the amount of crystalloid used for co-loading ad neonatal outcome in parturients with low (PI<3.82) and high (PI>3.82) baseline PI value.

Hence, we conclude that there is a significant correlation between perfusion index and subarachnoid block induced hypotension in parturients undergoing lower segment caesarean section. Parturients

with higher baseline PI value are at a greater risk of developing hypotension.

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Sr No.	MRD No.	AGE	HEIGHT	WEIGHT	BMI	Before_PI AT 1MIN	Before_PI AT 2MIN	Before_ PI AT 3 MIN	mean pi	Before_SBP AT 1 MIN	Before_SBP AT 2 MIN	Before_SBP AT 3 MIN	Before_MEAN OF THREE SBP	Before_DBP AT 1 MIN	Before_DBP AT 2 MIN	Before_DBP AT 3 MIN	Before_MAP AT 1 MIN	Before_MAP AT 2 MIN	Before_MAP AT 3 MIN	Before_HR AT 1 MIN	Before_HR AT 2 MIN	Before_HR AT 3 MIN	Before_SpO_2 AT 1 MIN	Before_SpO_2 AT 2 MIN
1	853648	32	152	68	29.3	2.8	3.2	3.8	3.3	116	118	120	118	78	75	78	91	91	93	73	74	73	97	97
2	873802	25	160	69	26.9	0.45	0.5	0.9	0.6	133	128	130	130	85	78	80	104	94	96	96	92	94	100	100
3	739940	25	152	62	26.7	1.2	1	0.8	1.0	130	132	134	132	74	72	70	92	92	91	76	78	80	100	100
4	850385	25	165	73	26.8	1.6	1	0.8	1.1	132	140	138	136	78	82	80	96	101	99	80	88	86	100	100
5	877353	29	165	60	22	1.2	1.6	1.2	1.3	138	130	136	134	76	68	74	96	88	94	84	88	86	100	100
6	765591	27	154	57	23.7	1	1.2	1.2	1.1	128	126	130	128	72	70	72	90	88	91	92	90	94	100	100
7	643741	28	150	61	26.3	6.9	6.2	5.8	6.3	148	143	131	140	95	86	87	108	105	103	73	69	70	97	98
8	907274	29	157	65	26.2	6.2	5.8	6	6.0	132	138	140	136	80	84	90	97	102	106	98	96	90	99	99
9	907936	32	162	80.5	30.3	5.6	5.3	5.7	5.5	147	133	127	135	80	82	86	102	99	99	112	105	107	97	97
10	908345	30	162.5	89	33.7	6.2	6.4	6.5	6.4	136	138	138	137	78	82	80	97	100	99	89	92	90	100	100
11	6885	35	165.1	76	27.9	9.3	8.9	10	9.4	132	132	116	126	74	64	58	86	95	86	92	90	92	97	97
12	908350	23	160	65	25.4	1.9	1.9	1.8	1.9	136	134	134	134	76	76	76	96	95	95	106	104	102	98	98
13	676559	25	167.6	80	28.5	2	2.1	3.4	2.5	128	128	118	124	68	66	64	88	86	82	106	102	104	97	98
14	914890	25	165.1	64	23.5	3.8	4	3.7	3.8	140	134	130	134	67	73	64	99	99	97	104	109	106	100	100
15	125548	37	162.5	75	28.4	6	6.2	6.2	6.1	128	130	132	130	76	72	74	93	91	93	108	109	110	98	98
16	38770	26	157.4	74	28.6	3.2	3	3.4	3.2	130	128	126	128	72	68	70	91	88	88	82	84	82	99	99
17	916661	39	162.5	76	28.8	4.2	4.2	4	4.1	138	140	142	140	82	84	82	100	102	102	84	82	80	98	98
18	830117	32	157.4	90	36.3	3.8	3.6	3.6	3.7	145	148	142	145	100	102	98	115	117	112	102	100	104	98	98
19	920215	34	157.4	64	25.8	5.7	4.3	4	4.7	126	120	118	121	78	74	73	97	92	89	96	98	101	99	98
20	807841	28	167.6	82	29.2	3.8	4	5.2	4.3	146	140	142	142	76	72	78	99	94	99	76	78	77	98	100
21	921212	24	162.5	70	26.5	3.8	3.6	3.4	3.6	122	124	128	124	68	70	68	86	88	88	80	86	84	99	99
22	453396	29	157.4	72	29	3.8	3.5	3.6	3.6	130	136	128	131	90	90	82	103	105	97	76	78	84	99	99
23	803189	29	157.4	78	31.5	6.4	6.8	7	6.7	136	140	132	136	82	78	80	100	98	97	88	90	92	99	99
24	921421	32	162.5	70	26.5	4.2	4	3.8	4.0	130	128	132	130	96	90	88	107	102	102	72	76	80	99	99
25	921544	28	160	74	28.9	2.6	2.8	3	2.8	132	126	128	128	88	90	78	102	102	94	78	82	80	99	99
26	297759	39	162.5	74	28	4.8	5.6	6	5.5	126	128	122	125	78	86	82	94	100	95	74	72	78	99	99
27	786890	27	167.4	78	27.2	1.2	1.6	1.4	1.4	136	132	130	132	84	88	90	101	102	103	102	104	100	99	99
28	907845	24	162.5	74	28	3	2.8	2	2.6	130	136	128	131	92	86	88	104	102	101	92	99	94	99	99
29	922548	23	162.5	72	27.2	3.5	3.8	4	3.8	136	132	138	135	78	72	74	97	92	95	74	78	80	99	99
30	922523	24	157.4	68	27.4	3.6	4	3.8	3.8	128	132	130	130	68	74	76	88	93	94	86	88	84	99	99
31	921044	30	167.6	72	25.2	4.2	5.8	4.8	4.9	142	138	144	141	84	86	88	103	103	106	82	84	88	99	99
32	924870	26	172.7	78	26.1	1	1.2	1.2	1.1	140	136	138	138	73	68	72	95	90	94	129	126	128	99	99
33	934677	29	167.6	80	28.5	2.6	2.4	2.8	2.6	138	140	136	138	78	84	80	98	102	98	76	82	80	100	100
34	539598	33	154.9	68	28.3	1.6	1.5	1.4	1.5	124	128	130	127	72	76	72	89	93	91	76	80	82	99	99
35	936647	33	162.5	78	29.5	2.6	2.8	3	2.8	138	140	136	138	76	82	78	96	101	97	78	82	80	99	99
36	939015	30	165	80	29.4	3.5	3.6	3.8	3.6	130	126	134	130	92	96	90	104	106	104	92	96	98	99	99
37	586712	45	160	72	28.1	5	5.4	4.8	5.1	138	136	140	138	80	86	78	99	102	98	78	76	80	99	99
38	922283	28	165.1	74	27.1	3.5	4	3.2	3.6	140	136	142	139	88	82	84	105	100	103	78	82	80	99	99
39	807222	29	162.5	70	26.5	3.2	3.6	2.8	3.2	128	122	126	125	76	82	88	93	95	100	82	86	84	99	99
40	572547	27	162.5	104	39.4	4.9	5.4	5.2	5.2	154	166	147	155	90	96	96	111	119	113	108	109	110	99	98
41	950072	31	160	62	24.2	6.2	6	5.8	6.0	128	122	130	126	68	74	62	88	90	84	74	76	80	99	98
42	551197	37	154.9	66	27.5	5.4	6	7.2	6.2	132	136	128	132	64	72	70	86	93	89	76	78	90	99	99
43	894117	31	157.4	62	25	3.8	4.6	3.4	3.9	128	132	122	127	74	64	68	92	86	86	68	74	78	99	98
44	110700	45	167.6	80	28.5	8.2	8	7.6	7.9	110	104	116	110	70	68	72	83	80	86	78	72	76	99	99
45	950213	30	162.5	88	33.3	3.8	2.2	2.6	2.9	132	138	122	130	78	82	78	96	100	92	72	76	78	99	99
46	883360	30	157.4	78	31.5	2.2	2.8	3.8	2.9	130	126	116	124	68	78	80	88	94	92	78	72	88	99	99
47	965249	30	144.7	64	30.5	3.2	3.4	2.8	3.1	122	126	116	121	64	72	66	83	90	82	74	76	76	99	99
48	965951	29	165.1	72	26.4	4.8	5.2	4.2	4.7	130	142	136	136	72	84	82	94	103	100	92	102	106	99	99
49	924586	39	162.5	72	27.2	4.5	4.8	4.2	4.5	130	126	136	130	68	78	72	88	92	93	88	86	90	99	99
50	970365	33	167.6	76	27	4.8	5.6	5.8	5.4	126	120	124	123	74	82	90	91	94	101	92	96	92	99	99
51	407981	31	167.6	68	24.2	4	3.2	3.4	3.5	124	128	130	127	70	68	78	88	88	95	106	101	98	97	99
52	972030	29	157.4	68	27.4	6.2	6	6.8	6.3	122	116	110	116	72	78	74	88	90	86	76	78	78	99	99
53	926754	32	167.6	80	28.5	3.8	4.2	3.2	3.7	138	128	136	134	88	94	90	104	105	105	96	92	94	99	99
54	837214	27	157.4	74	29.8	2.6	2.8	2.2	2.5	148	136	140	141	82	88	90	104	104	106	80	84	82	99	99
55	974489	32	162.5	78	29.5	3.8	2.6	1.8	2.7	142	132	138	134	74	88	90	96	102	106	98	102	106	99	99
56	997630	36	162.5	70	26.5	4.8	4.6	5.2	4.9	136	128	140	134	76	72	86	96	90	104	92	98	94	99	99
57	1001869	32	170.1	85	29.3	6.2	6.6	6.4	6.4	122	128	120	123	68	72	64	86	90	82	90	88	82	99	99
58	963216	35	160	66	25.8	5.4	5.2	5	5.2	126	120	128	124	72	68	78	90	85	94	78	76	78	99	99
59	1004851	37	162.5	70	26.5	4.6	3.8	3.6	4.0	142	156	140	146	100	96	98	114	116	112	106	96	102	99	99
60	1004889	27	160	75	29.3	1.1	0.91	1.6	1.2	126	128	137	130	88	94	93	100	105	107	99	98	96	100	100
61	568535	27	160	66	25.8	2.6	3.8	4.2	3.5	148	140	150	146	100	92	90	116	112	110	96	98	102	100	100
62	1005973	35	157.4	75	30.2	1.7	1.2	1.4	1.4	164	141	133	146	87	91	81	112	107	98	74	82	78	100	99
63	184774	25	162.5	70	26.5	1.6	1.8	1.2	1.5	136	138	132	135	78	82	90	97	100	104	90	92	88	99	99
64	400414	32	157.4	65	26.2	4.1	3.8	5.2	4.4	126	121	128	125	76	80	72	97	93	90	125	115	114	99	99
65	400414	32	162	65	24.6	5.2	6.2	8.4	6.6	120	130	126	125	70	72	64	86	91	84	92	96	88	98	98
66	1021223	27	167	75	26.9	2.1	3.5	2.4	2.7	130	136	128	131	76	74	72	94	94	90	102	104	100	98	98
67	823555	28	157	70	28.4	5.2	5.4	6.6	5.7	126	118	128	124	64	62	56	84	80	80	82	80	86	98	98
68	1019413	21	162.5	65	24.6	1.8	2.6	2.8	2.4	122	127	120	123	76	82	78	91	97	92	92	98	90	99	99
69	1022162	22	162.5	70	26.5	1.6	1.6	1.2	1.5	140	138	136	138	88	82	86	105	100	102	90	88	92	99	99
70	641704	32	165.1	85	31.2	8.8	9.2	10	9.3	137	139	134	136	74	86	83	98	105	106	83	76	85	99	99

Sr No.	MRD No.	Before_SpO2 AT 3 MIN	After_PI AT 1 MIN	PI AT 2 MIN	PI AT 3 MIN	PI AT 4 MIN	PI AT 5 MIN	PI AT 6 MIN	PI AT 7 MIN	PI AT 8 MIN	PI AT 9 MIN	PI AT 10 MIN	PI AT 11 MIN	PI AT 12 MIN	SBP AT 1 MIN	SBP AT 2 MIN	SBP AT 3 MIN	SBP AT 4 MIN	SBP AT 5 MIN	SBP AT 6 MIN	SBP AT 7 MIN	SBP AT 8 MIN	SBP AT 9 MIN	SBP AT 10 MIN	SBP AT 11 MIN	SBP AT 12 MIN	DBP AT 1 MIN	DBP AT 2 MIN	DBP AT 3 MIN	DBP AT 4 MIN	DBP AT 5 MIN	DBP AT 6 MIN	DBP AT 7 MIN	DBP AT 8 MIN
1	853648	98	2.4	1.5	1.1	1.2	1.9	1.3	1.4	1.5	1.6	2	1.6	1.8	114	111	108	118	110	114	114	108	110	116	120	116	69	69	53	59	61	60	60	60
2	873802	100	1.4	0.88	0.65	0.78	0.67	0.76	1	0.82	0.96	-	-	-	123	102	125	115	111	114	116	112	119	-	-	-	83	63	72	76	81	67	68	67
3	739940	100	0.6	0.51	0.46	0.54	0.56	1	0.8	0.9	1	0.6	1.2	0.94	128	127	128	121	126	122	124	122	128	120	130	126	82	62	76	59	72	60	66	70
4	850385	100	1.2	1.8	1.2	1.6	1	0.9	1	1.2	1.2	0.8	-	-	136	122	124	130	128	120	118	122	120	128	-	-	82	76	72	70	76	68	64	66
5	877353	100	1.2	1.4	1.8	1.2	0.9	1	1.2	1	0.8	1.8	1.6	-	132	122	128	124	120	118	114	118	120	118	122	-	72	68	62	66	68	58	62	66
6	765591	100	1.2	1.6	1.8	1.4	1	1.2	1.2	1.4	1.2	1	1.4	1.8	130	126	116	114	110	118	122	120	126	124	120	128	78	72	68	58	56	54	70	72
7	643741	98	5.4	5.1	4.8	4.4	4.2	3.9	3.8	3.5	3.6	3	3.2	-	138	113	116	110	114	121	119	128	120	124	118	-	59	65	65	67	69	72	76	73
8	907274	98	6.4	6.2	6	5.6	5.8	4.2	3.8	4	3.2	2.8	-	-	132	118	112	122	120	128	126	130	122	128	-	-	74	62	66	58	62	66	62	68
9	907936	97	5.2	5	3.9	5.4	5	2.4	1.8	1.6	1.2	1.3	1.6	-	117	130	125	94	104	118	123	130	133	128	124	-	80	84	72	52	52	68	69	68
10	908345	100	7.7	7.4	7.8	7.6	7.2	7	7.2	7	6.2	6.4	-	-	107	94	92	102	106	126	122	128	130	126	-	-	55	52	50	58	62	70	72	76
11	6885	98	7.8	9	9.9	11	7.5	8.5	10	9	8.4	8.8	-	-	136	124	90	136	130	130	128	126	128	130	-	-	62	40	38	70	68	68	78	80
12	908350	98	2.8	2.9	2.9	3.3	2.9	2.4	2.1	2	2.2	-	-	-	124	120	116	116	110	110	112	120	122	-	-	-	68	66	70	68	62	68	66	68
13	676559	98	3.4	3.3	3.1	2.8	2.3	2.3	2	2.1	2.6	2.2	1.6	1	126	110	112	128	128	127	134	130	126	130	132	128	60	54	52	58	64	62	68	64
14	914890	100	5.1	5.4	4.4	3.9	5	4.2	4.5	5.2	5	4.8	-	-	126	119	123	129	121	118	121	121	117	126	-	-	58	72	67	65	67	65	58	60
15	125548	98	6	5.6	6	5.4	5.8	5	5.2	4.2	4	-	-	-	128	120	110	108	114	120	124	126	128	-	-	-	64	62	56	52	58	60	62	66
16	38770	99	3.2	4	3.6	3.2	2.8	3.2	2.8	2.6	2.4	2.2	-	-	130	110	108	112	114	120	124	122	126	124	-	-	72	66	60	64	68	62	68	64
17	916661	98	4.8	4.8	4.6	5	5.1	4.2	4	4	4.4	3.8	3.4	-	138	126	108	110	118	122	120	122	124	126	130	-	82	76	64	68	66	70	72	68
18	830117	98	4	4.2	4	3.8	3.6	3.2	3	3.2	3.4	-	-	-	145	120	112	110	122	128	130	126	124	-	-	-	100	84	72	68	68	70	68	64
19	920215	97	6.2	6.4	7	6	5.2	4.6	4.2	4.4	3.6	3.8	-	-	114	102	96	118	122	118	126	122	124	128	-	-	64	56	46	62	66	62	64	68
20	807841	100	5.2	5	4.6	5	4.2	4	4.2	4.4	4	-	-	-	132	118	102	98	108	116	120	126	122	-	-	-	66	58	52	48	52	56	58	64
21	921212	99	3.4	3.6	4	3.4	3.6	3.6	3.2	3.2	3	3.8	3.2	-	128	112	108	106	109	116	112	118	110	116	112	-	68	62	56	58	60	62	66	62
22	453396	99	3.8	3.8	4	4.2	4	3.8	3.2	3.6	3.5	-	-	-	120	108	110	112	110	118	120	122	120	-	-	-	76	62	66	60	58	64	66	62
23	803189	99	7	7.6	7.2	7.8	7	6.2	6	5.4	5.8	-	-	-	132	108	78	98	110	118	122	120	122	-	-	-	80	68	40	48	52	58	62	60
24	921421	99	3.8	4	4.5	4.2	3.6	3.4	3.6	3.8	3.2	3.5	-	-	132	108	110	118	116	122	124	120	118	-	-	-	88	66	68	64	62	68	66	70
25	921544	99	3	3.5	3.2	3	2.6	2	1.6	1.8	1.2	-	-	-	128	118	115	110	116	120	122	120	118	-	-	-	78	68	62	70	72	68	72	70
26	297759	99	5.6	5.2	5.8	5	4.6	3.8	4	4.2	4	-	-	-	126	108	109	112	110	106	110	118	116	-	-	-	78	68	64	62	66	62	58	64
27	786890	98	1.6	1.8	2	1.4	1.8	2	2.2	2.4	2	-	-	-	132	128	110	116	112	118	116	122	120	-	-	-	88	80	68	72	70	66	68	74
28	907845	99	2.6	2.4	2	1.6	1.8	2.2	2	2.2	1.6	1.2	1.4	-	128	110	112	114	108	110	112	118	120	116	122	-	88	74	70	68	70	72	70	74
29	922548	99	3.8	3.8	3.6	4	3.5	3.5	3.2	3.4	3.2	-	-	-	132	118	116	114	122	120	116	114	120	-	-	-	72	68	66	62	58	64	62	54
30	922523	99	4	3.6	3.8	3.2	4	3.6	3	3.5	3.6	3.5	-	-	128	118	112	108	116	112	116	122	120	118	-	-	68	64	62	52	58	56	62	66
31	921044	99	4.8	5.4	5	4.6	3.8	4	4.2	4.6	4	-	-	-	144	126	108	102	116	118	114	122	126	-	-	-	88	70	62	56	64	62	68	74
32	924870	99	1.2	1.6	1.8	1.6	1.2	1.4	1.2	1.3	-	-	-	-	138	130	114	118	110	118	130	118	-	-	-	-	72	78	69	52	62	69	76	64
33	934677	100	2.8	3.2	3	2.6	2.6	2.4	2	2.2	2	-	-	-	136	122	118	122	126	122	130	124	126	-	-	-	80	68	64	62	70	66	72	68
34	539598	99	1.7	1.5	1.4	1.4	1.6	1.6	2.2	1.8	-	-	-	-	119	121	115	120	125	122	103	116	-	-	-	-	84	75	73	75	77	75	56	60
35	936647	99	3	3.8	3.6	2.8	2.6	2.8	2	2.2	2	1.4	-	-	136	108	110	116	128	120	126	122	128	126	-	-	78	64	62	64	68	64	68	66
36	939015	98	3.2	3	3.2	2.8	3	3.2	-	-	-	-	-	-	126	116	110	114	120	122	-	-	-	-	-	-	88	76	64	68	74	78	-	-
37	586712	99	4.8	4.5	5	3.8	4	4	4.2	3.6	3.2	-	-	-	140	130	122	126	118	128	126	122	128	-	-	-	82	76	78	72	60	68	66	72
38	922283	99	3.4	4	3.5	3.2	3	2.8	2.6	3	-	-	-	-	138	130	120	122	126	120	128	130	-	-	-	-	72	70	62	64	70	72	68	62
39	807222	99	2.8	3	3.6	3.8	3.2	3	2.2	1.6	1.8	-	-	-	136	122	118	106	112	128	122	120	118	-	-	-	82	86	72	64	60	58	62	68
40	572547	99	3.9	4.2	4	4.4	2.6	2.7	1	2	1.8	2	2.6	2	160	110	94	110	153	148	139	145	142	138	134	-	100	78	60	70	92	98	61	98
41	950072	99	6	5.4	5	5.6	4.8	4.2	3.2	4.4	4	-	-	-	120	84	88	99	104	130	126	128	122	-	-	-	62	40	44	52	56	62	60	70
42	551197	99	6.8	7	5.4	5.8	6	4.8	4	4.6	5	4.2	4	-	126	112	94	104	110	106	118	122	126	124	120	-	70	66	44	56	66	58	64	70
43	894117	98	3.2	3.6	2.8	2.6	3.4	3	2.4	1.6	1.8	-	-	-	132	118	110	114	126	122	120	126	118	-	-	-	66	54	62	68	70	68	74	70
44	110700	99	7.2	8	9	8.5	7.2	6	6.5	5.8	5.6	5	-	-	108	104	80	84	98	102	110	108	106	110	-	-	70	54	48	52	56	54	62	64
45	950213	99	3.8	4	3.2	2.6	2.8	3.8	3	3	-	-	-	-	130	126	128	122	116	118	122	120	-	-	-	-	76	72	70	74	68	62	72	78
46	883360	99	3.2	3.5	3.6	4	2.8	2.2	2.6	3	3.2	-	-	-	128	116	102	116	112	130	136	140	138	-	-	-	72	70	58	68	62	72	80	84
47	965249	99	3	3.5	4.2	4	3.8	3	3.4	3.2	2.6	2.2	2.8	-	126	112	106	108	110	108	116	112	116	118	114	-	66	62	52	56	54	62	68	70
48	965951	99	5.2	4.8	3.2	3.6	3.8	4.2	4.2	4	4.4	-	-	-	140	136	108	90	98	116	112	130	136	-	-	-	72	70	64	48	52	72	80	76
49	924586	99	4.8	5.6	5.4	4.2	3.5	3.8	3.6	3.2	3	-	-	-	132	126	102	106	120	122	118	128	130	-	-	-	62	68	54	56	64	78	68	70
50	970365	99	6.2	7.6	7	6.8	6	5.2	5.4	4.2	4.8	5.2	4	-	128	90	96	106	110	130	126	128	120	130	124	122	60	52	42	64	62	70	68	64
51	407981	99	3.6	3.5	3.2	4	4.2	3.2	2.8	3.5	3.2	-	-	-	130	120	118	106	110	112	130	132	128	-	-	-	76	70	68	64	72	80	70	76
52	972030	99	6.8	6.2	5.8	6	5.2	4.8	5	3.8	4.6	-	-	-	128	112	102	80	76	92	118	122	116	-	-	-	78	62	54	48	42	58	64	62
53	926754	99	3.8	4.2	3.6	4.8	4.6	4.2	3.8	3.6	3.8	3.2	-	-	130	120	116	112	118	126	122	130	140	138	-	-	68	70	64	58	62	64	72	58
54	837214	99	2.8	3.6	3.2	4	3.2	3.5	3.1	4.6	4	-	-	-	140	106	110	122	118	128	122	130	136	-	-	-	88	46	50	58	56	64	72	68
55	974489	99	1.6	2.4	4.4	3.6	2.8	2.8	3.4	3.6	3.4	3.2	-	-	140	126	108	104	112	116	122	130	136	124	-	-	88	68	64	56	62	66	64	78
56	997630	99	5.6	6.2	5.8	4.6	4.8	4	3.4	3.6	3.8	3	3.2	3.2	140	132	130	122	118	126	130	136	128	126	138	130	90	88	82	76	72	68	76	74
57	1001869	99	6.6	7.2	9	8.8	6.4	7.2	6	-	-	-	-	-	106	88	96	110	114	120	118	-	-	-	-	-	62	38	56	60	62	64	62	-
58	963216	99	5.6	6	5.8	5.2	5.4	4.6	-	-	-	-	-	-	126	116	70	92	106	110	-	-	-	-	-	-	68	60	36	48	62	66	-	-
59	1004851	99	3.8	4	3.5	3.2	3.6	2	2.4	2.2	2.4	-	-	-	142	140	136	138	140	136	128	136	134	-	-	-	90	96	82	84	86	82	78	76
60	1004889	100	1.8	1.4	1.6	1.4	2	1.6	1.8	1.8	0.9	1	-	-	136	122	128	130	136	126	120	118	126	128	-	-	86	82	90	72	78	82	68	62
61	568535	100	4.2	4	3.6	2.8	3.4	3	3.5	4.6	3.2	-	-	-	146	132	136	128	138	140	156	142	146	140	138	-	90	96	84	76	82	84	80	88
62	1005973	99	1.6	1.4	2	1.8	1.6	1.6	1.8	2	1.6	-	-	-	156	144	136	142	148	142	152	140	138	-	-	-	83	79	82	84	82	80	86	78
63	184774	99	1.8	1.6	1.4	1.2	1.6	1.2	-	-	-	-	-	-	136	128	118	122	126	130	-	-	-	-	-	-	82	72	68	72	72	76	-	-
64	400414	99	7.5	7.4	6.2	7.4	7.3	7.9	7.3	-	-	-	-	-	139	122	120	117	108	111	118	-	-	-	-	-	74	70	64	56	59	58	64	-
65	400414	98	6.8	7.2	9.6	8.2	9.2	6.6	6.2	5.6	4.2	-	-	-	122	104	96	106	102	110	114	103	116	-	-	-	72	66	50	56	54	62	66	62
66	1021223	98	4.2	3.5	2.6	3	2.8	1.6	2.4	1.2	-	-	-	-	126	122	130	126	122	128	136	130	-	-	-	-	76	62	64	68	72	84	82	80
67	823555	98	6.2	9.6	9.2	8.4	8.6	8.2	6.2	6	-	-	-	-	120	116	102	80	92	104	106	110	-	-	-	-	62	56	62	42	66	62	58	68
68	1019413	99	3.6	3.4	1.8	1.6	1.8	2	-	-	-	-	-	-	126	118	110	116	120	126	-	-	-	-	-	-	64	58	58	60	64	72	-	-
69	1022162	99	1.6	1.8	2.2	1.4	1.2	1.6	1.2	-	-	-	-	-	148	136	138	126	128	130	136	-	-	-	-	-	90	88	82	82	78	78	76	-
70	641704	99	10.2	8.6	9.2	6.4	7.2	7.4	-	-	-	-	-	-	132	116	90	106	110	122	-	-	-	-	-	-	88	64	42	56	68	74	-	-

Sr No.	MRD No.	DBP AT 9 MIN	DBP AT 10 MIN	DBP AT 11 MIN	DBP AT 12 MIN	MAP AT 1 MIN	MAP AT 2 MIN	MAP AT 3 MIN	MAP AT 4 MIN	MAP AT 5 MIN	MAP AT 6 MIN	MAP AT 7 MIN	MAP AT 8 MIN	MAP AT 9 MIN	MAP AT 10 MIN	MAP AT 11 MIN	MAP AT 12 MIN	HR AT 1 MIN	HR AT 2 MIN	HR AT 3 MIN	HR AT 4 MIN	HR AT 5 MIN	HR AT 6 MIN	HR AT 7 MIN	HR AT 8 MIN	HR AT 9 MIN	HR AT 10 MIN	HR AT 11 MIN	HR AT 12 MIN	SpO_2 AT 1 MIN	SpO_2 AT 2 MIN	SpO_2 AT 3 MIN
1	853648	64	62	60	64	84.0	83.0	71.3	78.7	77.3	78.0	78.0	76.0	79.3	80.0	80.0	81.3	74	87	114	72	85	71	68	74	74	76	78	78	99	100	100
2	873802	72	-	-	-	96.3	76.0	89.7	89.0	91.0	82.7	84.0	82.0	87.7	-	-	-	98	114	74	89	98	100	96	97	92	-	-	-	100	100	100
3	739940	68	66	64	60	97.3	83.7	93.3	79.7	90.0	80.7	85.3	87.3	88.0	84.0	86.0	82.0	81	81	77	92	102	98	92	96	98	36	97	96	100	100	100
4	850385	68	64	-	-	100.0	91.3	89.3	90.0	93.3	85.3	82.0	84.7	85.3	85.3	-	-	86	82	86	80	82	78	76	82	86	88	-	-	100	100	100
5	877353	68	66	64	-	92.0	86.0	84.0	85.3	85.3	78.0	79.3	83.3	85.3	83.3	83.3	-	90	92	90	88	96	92	98	96	96	92	84	-	100	100	100
6	765591	74	70	68	66	95.3	90.0	84.0	76.7	74.0	75.3	87.3	88.0	91.3	88.0	85.3	86.7	96	94	90	88	92	90	96	92	94	92	93	90	100	100	100
7	643741	78	70	68	-	85.3	81.0	82.0	81.3	84.0	88.3	90.3	91.3	92.0	88.0	84.7	-	71	71	73	74	82	71	71	73	71	68	65	-	98	99	99
8	907274	70	68	-	-	93.3	80.7	81.3	79.3	81.3	86.7	83.3	88.7	87.3	88.0	-	-	101	97	91	85	87	83	77	83	83	74	-	-	98	99	100
9	907936	76	68	70	-	92.3	99.3	89.7	66.0	69.3	84.7	87.0	88.7	95.0	88.0	88.0	-	106	111	113	101	93	89	89	107	104	96	98	-	99	98	98
10	908345	72	70	-	-	72.3	66.0	64.0	72.7	76.7	88.7	88.7	93.3	91.3	88.7	-	-	106	85	87	85	81	83	87	89	89	82	-	-	100	100	100
11	6885	80	78	-	-	86.7	68.0	55.3	92.0	88.7	88.7	94.7	95.3	96.0	95.3	-	-	94	72	38	70	76	82	88	92	96	92	-	-	97	96	95
12	908350	70	-	-	-	86.7	84.0	85.3	84.0	78.0	82.0	81.3	85.3	87.3	-	-	-	98	96	98	92	94	92	92	92	90	-	-	-	98	98	98
13	676559	64	66	68	62	82.0	72.7	72.0	81.3	85.3	83.7	90.0	86.0	84.7	87.3	89.3	84.0	106	108	102	104	98	96	100	100	99	96	98	94	99	98	98
14	914890	60	56	-	-	80.7	87.7	85.7	86.3	85.0	82.7	79.0	80.3	79.0	79.3	-	-	107	109	111	115	112	116	111	117	111	108	-	-	100	100	100
15	125548	70	-	-	-	85.3	81.3	74.0	70.7	76.7	80.0	82.7	86.0	89.3	-	-	-	113	111	109	107	109	109	106	106	101	-	-	-	98	98	98
16	38770	60	64	-	-	91.3	80.7	76.0	80.0	83.3	81.3	86.7	83.3	82.0	84.0	-	-	90	92	90	88	84	86	88	82	82	84	-	-	99	99	99
17	916661	66	64	66	-	100.7	92.7	78.7	82.0	83.3	87.3	88.0	86.0	85.3	84.7	87.3	-	87	89	85	81	79	83	81	79	79	78	76	-	98	98	98
18	830117	68	-	-	-	115.0	96.0	85.3	82.0	86.0	89.3	88.7	84.7	86.7	-	-	-	106	108	96	92	96	98	98	100	99	-	-	-	98	98	98
19	920215	66	68	-	-	80.7	71.3	62.7	80.7	84.7	80.7	84.7	86.0	85.3	88.0	-	-	101	91	89	85	83	87	85	85	83	80	-	-	82	96	98
20	807841	62	-	-	-	88.0	78.0	68.7	64.7	70.7	76.0	78.7	84.7	82.0	-	-	-	78	72	68	56	62	64	70	77	82	-	-	-	99	99	98
21	921212	64	60	68	-	88.0	78.7	73.3	74.0	76.3	80.0	81.3	80.7	79.3	78.7	82.7	-	84	80	78	76	78	79	82	80	80	78	78	-	99	99	99
22	453396	68	-	-	-	90.7	77.3	80.7	77.3	75.3	82.0	84.0	82.0	85.3	-	-	-	78	79	80	76	72	74	80	82	80	-	-	-	99	99	99
23	803189	70	-	-	-	97.3	81.3	52.7	64.7	71.3	78.0	82.0	80.0	87.3	-	-	-	97	97	89	85	81	83	83	85	85	-	-	-	99	98	98
24	921421	72	70	-	-	102.7	80.0	82.0	82.0	80.0	86.0	85.3	86.7	87.3	#VALUE!	-	-	83	85	79	81	81	79	83	83	81	74	-	-	99	99	99
25	921544	68	-	-	-	94.7	84.7	79.7	83.3	86.7	85.3	88.7	86.7	84.7	-	-	-	80	80	76	74	78	82	82	80	76	-	-	-	99	99	99
26	297759	62	-	-	-	94.0	81.3	79.0	78.7	80.7	76.7	75.3	82.0	80.0	-	-	-	77	79	77	73	77	76	77	79	77	-	-	-	99	99	99
27	786890	68	-	-	-	102.7	96.0	82.0	86.7	84.0	83.3	84.0	90.0	85.3	-	-	-	104	106	102	98	98	96	98	96	92	-	-	-	99	99	99
28	907845	72	70	68	-	101.3	86.0	84.0	83.3	82.7	84.7	84.0	88.7	88.0	85.3	86.0	-	94	92	82	86	84	88	88	86	86	84	84	-	99	99	99
29	922548	66	-	-	-	92.0	84.7	82.7	79.3	79.3	82.7	80.0	74.0	84.0	-	-	-	86	82	78	80	82	80	82	78	77	-	-	-	99	99	99
30	922523	64	68	-	-	88.0	82.0	78.7	70.7	77.3	74.7	80.0	84.7	82.7	84.7	-	-	88	80	82	80	76	78	78	80	80	82	-	-	99	99	100
31	921044	72	-	-	-	106.7	88.7	77.3	71.3	81.3	80.7	83.3	90.0	90.0	-	-	-	93	85	83	77	77	81	79	83	83	-	-	-	99	99	99
32	924870	-	-	-	-	94.0	95.3	84.0	74.0	78.0	85.3	94.0	82.0	-	-	-	-	130	132	128	122	124	118	112	108	-	-	-	-	99	10	100
33	934677	70	-	-	-	98.7	86.0	82.0	82.0	88.7	84.7	91.3	86.7	88.7	-	-	-	80	76	74	78	82	84	82	86	80	-	-	-	100	100	100
34	539598	-	-	-	-	95.7	90.3	87.0	90.0	93.0	90.7	71.7	78.7	-	-	-	-	92	92	95	97	82	84	78	82	-	-	-	-	100	100	100
35	936647	68	70	-	-	97.3	78.7	78.0	81.3	88.0	82.7	87.3	84.7	88.0	88.7	-	-	78	70	68	70	74	76	76	72	72	70	-	-	100	100	100
36	939015	-	-	-	-	100.7	89.3	79.3	83.3	89.3	92.7	-	-	-	-	-	-	100	101	96	98	92	90	-	-	-	-	-	-	99	98	98
37	586712	78	-	-	-	101.3	94.0	92.7	90.0	79.3	88.0	86.0	88.7	94.7	-	-	-	83	89	91	93	91	85	79	85	81	-	-	-	99	99	99
38	922283	-	-	-	-	94.0	90.0	81.3	83.3	88.7	88.0	88.0	84.7	-	-	-	-	78	82	90	92	88	82	84	82	-	-	-	-	99	99	99
39	807222	78	-	-	-	100.0	98.0	87.3	78.0	77.3	81.3	82.0	85.3	91.3	-	-	-	82	88	92	96	90	90	82	84	86	-	-	-	99	99	99
40	572547	88	78	84	82	120.0	88.7	71.3	83.3	112.3	114.7	87.0	113.7	106.0	98.0	100.7	#VALUE!	97	87	79	75	87	120	106	115	114	110	108	108	98	100	100
41	950072	64	-	-	-	81.3	54.7	58.7	67.7	72.0	84.7	82.0	89.3	83.3	-	-	-	83	81	77	73	75	83	79	77	75	-	-	-	99	98	96
42	551197	64	66	68	-	88.7	81.3	60.7	72.0	80.7	74.0	82.0	87.3	84.7	85.3	85.3	-	85	95	85	81	77	83	83	79	79	74	76	-	99	99	99
43	894117	74	-	-	-	88.0	75.3	78.0	83.3	88.7	86.0	89.3	88.7	88.7	-	-	-	81	91	93	89	83	79	83	81	81	-	-	-	98	99	99
44	110700	66	60	-	-	82.7	70.7	58.7	62.7	70.0	70.0	78.0	78.7	79.3	76.7	-	-	81	77	73	81	85	81	77	75	73	67	-	-	99	99	99
45	950213	-	-	-	-	94.0	90.0	89.3	90.0	84.0	80.7	88.7	92.0	-	-	-	-	78	80	82	80	78	-	76	72	-	-	-	-	82	99	99
46	883360	86	-	-	-	90.7	85.3	72.7	84.0	78.7	91.3	98.7	102.7	103.3	-	-	-	78	82	96	90	88	92	90	90	89	-	-	-	99	99	99
47	965249	72	68	66	-	86.0	78.7	70.0	73.3	72.7	77.3	84.0	84.0	86.7	84.7	82.0	-	76	72	74	72	76	80	80	76	76	77	76	-	99	99	99
48	965951	70	-	-	-	94.7	92.0	78.7	62.0	67.3	86.7	90.7	94.0	92.0	-	-	-	113	121	111	101	97	91	97	97	93	-	-	-	99	99	99
49	924586	80	-	-	-	85.3	87.3	70.0	72.7	82.7	92.7	84.7	89.3	96.7	-	-	-	97	97	81	77	79	85	79	79	77	-	-	-	99	98	98
50	970365	68	70	76	74	82.7	64.7	60.0	78.0	78.0	90.0	87.3	85.3	85.3	90.0	92.0	90.0	95	91	85	71	77	83	79	85	83	80	81	80	99	99	99
51	407981	78	-	-	-	94.0	86.7	84.7	78.0	84.7	90.7	90.0	94.7	94.7	-	-	-	102	106	102	98	96	92	78	84	82	-	-	-	99	99	99
52	972030	72	-	-	-	94.7	78.7	70.0	58.7	53.3	69.3	82.0	82.0	86.7	-	-	-	81	81	87	91	79	77	71	75	77	-	-	-	99	99	99
53	926754	76	72	-	-	88.7	86.7	81.3	76.0	80.7	84.7	88.7	82.0	97.3	94.0	-	-	94	90	86	82	88	92	98	100	100	99	-	-	99	99	99
54	837214	80	-	-	-	105.3	66.0	70.0	79.3	76.7	85.3	88.7	88.7	98.7	-	-	-	86	72	62	68	76	76	72	72	74	-	-	-	99	99	99
55	974489	74	72	-	-	105.3	87.3	78.7	72.0	78.7	82.7	83.3	95.3	94.7	89.3	-	-	102	106	98	92	90	96	92	92	92	90	-	-	99	99	99
56	997630	70	72	68	74	106.7	102.7	98.0	91.3	87.3	87.3	94.0	94.7	89.3	90.0	91.3	92.7	101	101	103	105	99	97	89	95	94	90	89	90	99	99	99
57	1001869	-	-	-	-	76.7	54.7	69.3	76.7	79.3	82.7	80.7	-	-	-	-	-	91	93	91	85	87	85	81	-	-	-	-	-	99	99	99
58	963216	-	-	-	-	87.3	78.7	47.3	62.7	76.7	80.7	-	-	-	-	-	-	83	89	91	87	85	87	-	-	-	-	-	-	99	98	97
59	1004851	84	-	-	-	107.3	110.7	100.0	102.0	104.0	100.0	94.7	96.0	100.7	-	-	-	111	117	111	107	109	101	105	103	97	-	-	-	100	100	100
60	1004889	76	74	-	-	102.7	95.3	102.7	91.3	97.3	96.7	85.3	80.7	92.7	92.0	-	-	98	102	96	92	94	96	88	89	88	84	-	-	100	100	100
61	568535	90	88	92	-	108.7	108.0	101.3	93.3	100.7	102.7	105.3	106.0	108.7	105.3	107.3	-	104	102	96	92	98	98	96	92	93	94	94	-	100	100	100
62	1005973	76	-	-	-	107.3	100.7	100.0	103.3	104.0	100.7	108.0	98.7	96.7	-	-	-	84	86	88	92	90	90	82	84	86	-	-	-	99	100	100
63	184774	-	-	-	-	100.0	90.7	84.7	88.7	90.0	94.0	-	-	-	-	-	-	90	92	88	82	86	88	-	-	-	-	-	-	99	99	99
64	400414	-	-	-	-	95.7	87.3	82.7	76.3	75.3	75.7	82.0	-	-	-	-	-	121	141	129	136	126	128	114	-	-	-	-	-	99	99	99
65	400414	70	-	-	-	88.7	78.7	65.3	72.7	70.0	78.0	82.0	75.7	85.3	-	-	-	97	99	97	91	81	79	83	81	83	-	-	-	98	97	97
66	1021223	-	-	-	-	92.7	82.0	86.0	87.3	88.7	98.7	100.0	96.7	-	-	-	-	98	92	100	102	102	100	98	96	-	-	-	-	99	99	99
67	823555	-	-	-	-	81.3	76.0	75.3	54.7	74.7	76.0	74.0	82.0	-	-	-	-	87	89	81	77	71	73	73	75	-	-	-	-	98	97	96
68	1019413	-	-	-	-	84.7	78.0	75.3	78.7	82.7	90.0	-	-	-	-	-	-	96	92	88	84	88	92	-	-	-	-	-	-	99	99	99
69	1022162	-	-	-	-	109.3	104.0	100.7	96.7	94.7	95.3	96.0	-	-	-	-	-	96	92	88	90	82	80	86	-	-	-	-	-	99	99	99
70	641704	-	-	-	-	102.7	81.3	58.0	72.7	82.0	90.0	-	-	-	-	-	-	93	99	87	89	85	91	-	-	-	-	-	-	99	99	99

Sr No.	MRD No.	SpO_2 AT 4 MIN	SpO_2 AT 5 MIN	SpO_2 AT 6 MIN	SpO_2 AT 7 MIN	SpO_2 AT 8 MIN	SpO2 AT 9 MIN	SpO2AT 10 MIN	SpO2AT 11 MIN	SpO2AT 12 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 1 MIN	BOLUSES OF VASOPRESSORS(IF USED) AT 2 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 3 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 4 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 5 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 6 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 7 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 8 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT9 MIN
1	853648	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0
2	873802	100	10	100	100	100	100	-	-	-	0	6	0	0	0	0	0	0	0
3	739940	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0
4	850385	100	100	100	100	100	100	100	-	-	0	0	0	0	0	0	0	0	0
5	877353	100	100	100	100	100	100	100	100	-	0	0	0	0	0	0	0	0	0
6	765591	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0
7	643741	99	99	99	99	99	99	99	99	-	0	0	0	6	0	0	0	0	0
8	907274	100	100	100	100	99	99	99	-	-	0	0	0	0	0	0	0	0	0
9	907936	100	100	100	100	100	100	100	100	-	0	0	0	6	0	0	0	0	0
10	908345	100	100	100	100	100	100	100	-	-	6	6	0	6	6	0	6	0	0
11	6885	97	97	97	97	98	98	98	-	-	0	6	6	0	0	0	0	0	0
12	908350	98	98	98	98	98	98	-	-	-	0	0	0	0	0	0	0	0	0
13	676559	97	98	98	98	97	97	97	97	97	0	0	0	0	0	0	0	0	0
14	914890	100	100	100	100	100	100	100	-	-	0	0	0	0	0	0	0	0	0
15	125548	98	98	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
16	38770	99	98	99	99	99	99	99	-	-	0	0	0	0	0	0	0	0	0
17	916661	98	98	98	98	98	98	98	98	-	6	0	6	0	0	0	0	0	0
18	830117	98	98	98	98	98	98	-	-	-	0	6	6	0	0	0	0	0	0
19	920215	98	98	98	98	97	97	98	-	-	0	6	0	0	0	0	0	0	0
20	807841	97	97	99	99	99	99	-	-	-	6	0	6	6	0	0	0	0	0
21	921212	99	99	99	99	99	99	99	99	-	0	0	0	0	0	0	0	0	0
22	453396	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
23	803189	99	99	99	99	99	99	-	-	-	0	6	6	0	6	0	0	0	0
24	921421	99	99	99	99	99	99	99	-	-	0	0	0	0	0	0	0	0	0
25	921544	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
26	297759	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
27	786890	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
28	907845	99	99	99	99	99	99	99	99	-	0	0	0	0	0	0	0	0	0
29	922548	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
30	922523	100	100	100	100	100	100	100	-	-	0	0	0	0	0	0	0	0	0
31	921044	99	99	99	99	99	99	-	-	-	0	6	6	0	0	0	0	0	0
32	924870	100	100	100	100	100	-	-	-	-	0	0	0	0	0	0	0	0	0
33	934677	100	100	100	100	100	100	-	-	-	0	0	0	0	0	0	0	0	0
34	539598	100	100	100	100	100	-	-	-	-	0	0	0	0	0	0	0	0	0
35	936647	100	100	100	100	100	100	100	-	-	0	6	0	0	0	0	0	0	0
36	939015	98	98	98	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
37	586712	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
38	922283	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
39	807222	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
40	572547	100	100	100	100	100	100	100	100	100	0	6	6	6	0	0	0	0	0
41	950072	99	99	99	99	99	99	-	-	-	0	6	6	0	6	0	0	0	0
42	551197	99	99	99	99	99	99	99	99	-	0	0	6	6	0	0	0	0	0
43	894117	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
44	110700	99	99	99	99	99	99	99	-	-	0	6	6	0	0	0	0	0	0
45	950213	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
46	883360	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
47	965249	99	99	99	99	99	99	99	99	-	0	0	0	0	0	0	0	0	0
48	965951	99	99	99	99	99	99	-	-	-	0	6	6	6	0	0	0	0	0
49	924586	98	97	99	99	99	99	-	-	-	0	6	6	0	0	0	0	0	0
50	970365	99	99	99	99	99	99	99	99	99	0	0	6	6	0	0	0	0	0
51	407981	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
52	972030	99	99	99	99	99	99	-	-	-	0	0	6	6	6	0	0	0	0
53	926754	99	99	99	99	99	99	99	-	-	0	0	0	0	0	0	0	0	0
54	837214	99	99	99	99	99	99	-	-	-	0	6	6	0	0	0	0	0	0
55	974489	99	99	99	99	99	99	99	-	-	0	0	6	0	6	0	0	0	0
56	997630	99	99	99	99	99	99	99	99	99	0	0	0	0	0	0	0	0	0
57	1001869	98	99	98	98	-	-	-	-	-	0	0	6	6	0	0	0	0	0
58	963216	98	98	98	-	-	-	-	-	-	0	0	6	6	0	0	0	0	0
59	1004851	99	99	100	100	100	100	-	-	-	0	0	0	0	0	0	0	0	0
60	1004889	99	99	100	100	100	100	100	-	-	0	0	0	0	0	0	0	0	0
61	568535	100	100	100	100	100	100	10	100	-	0	0	0	0	0	0	0	0	0
62	1005973	100	100	100	100	100	100	-	-	-	0	0	0	0	0	0	0	0	0
63	184774	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
64	400414	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
65	400414	97	97	98	98	98	98	-	-	-	0	0	6	0	0	0	0	0	0
66	1021223	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
67	823555	97	97	97	97	97	-	-	-	-	0	0	0	6	6	0	0	0	0
68	1019413	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
69	1022162	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
70	641704	99	99	99	-	-	-	-	-	-	0	0	0	6	6	0	0	0	0

Sr No.	MRD No.	1BOLUSES OF VASOPRESSORS (IF USED) AT10 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT11 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT12 MIN	EPISODES OF HYPOTENSION(SBP DECREASE TO LESS THAN EQUAL TO 80% OF BASELINE)	EPISODES OF BRADYCARDIA (HR< 60 PER MIN)	DOSE OF ATROPINE(MG) ADMINISTERED)	DOSE OF EPHEDRINE (MG) ADMINISTERED	AMOUNT OF CRYSTALLOID(ML) USED	EPISODES OF IONV	GRADING	INTERVENTION (DOSE OF ONDANSETRON(MG)) ADMINISTERED	APGAR SCORE AT 1 MIN	APGAR SCORE AT 5 MIN
1	853648	0	0	0	0	0	0	0	1200	0	0	0	8	9
2	873802	0	0	0	1	0	0	6	900	0	0	0	9	9
3	739940	0	0	0	0	0	0	0	800	0	0	0	8	9
4	850385	0	0	0	0	0	0	0	1200	0	0	0	9	9
5	877353	0	0	0	0	0	0	0	1100	0	0	0	9	9
6	765591	0	0	0	0	0	0	0	900	0	0	0	9	9
7	643741	0	0	0	1	0	0	6	1100	0	0	0	9	9
8	907274	0	0	0	0	0	0	0	1200	0	0	0	9	9
9	907936	0	0	0	1	0	0	6	1200	1	1	4	8	9
10	908345	0	0	0	5	0	0	30	1200	1	2	4	9	9
11	6885	0	0	0	2	1	0.6	6	1800	1	2	4	8	9
12	908350	0	0	0	0	0	0	0	1200	0	0	0	9	9
13	676559	0	0	0	0	0	0	0	1200	0	0	0	9	9
14	914890	0	0	0	0	0	0	0	1400	0	0	0	9	9
15	125548	0	0	0	0	0	0	0	1200	0	0	0	9	9
16	38770	0	0	0	0	0	0	0	1200	0	0	0	9	9
17	916661	0	0	0	2	0	0	12	1200	1	1	4	9	9
18	830117	0	0	0	2	0	0	18	1200	1	1	4	8	9
19	920215	0	0	0	1	0	0	6	1400	0	0	0	9	9
20	807841	0	0	0	3	1	0.6	18	1100	1	2	4	9	9
21	921212	0	0	0	0	0	0	0	1200	0	0	0	9	9
22	453396	0	0	0	0	0	0	0	1200	0	0	0	9	9
23	803189	0	0	0	3	0	0	18	1200	1	2	4	9	9
24	921421	0	0	0	0	0	0	0	1350	0	0	0	9	9
25	921544	0	0	0	0	0	0	0	1200	0	0	0	9	9
26	297759	0	0	0	0	0	0	0	1300	0	0	0	9	9
27	786890	0	0	0	0	0	0	0	1280	0	0	0	9	9
28	907845	0	0	0	0	0	0	0	1250	0	0	0	9	9
29	922548	0	0	0	0	0	0	0	1200	0	0	0	9	9
30	922523	0	0	0	0	0	0	0	1400	0	0	0	9	10
31	921044	0	0	0	2	0	0	12	1000	1	1	4	9	9
32	924870	0	0	0	0	0	0	0	1400	0	0	0	9	9
33	934677	0	0	0	0	0	0	0	1300	0	0	0	10	10
34	539598	0	0	0	0	0	0	0	1100	0	0	0	9	9
35	936647	0	0	0	1	0	0	6	1200	1	1	4	9	9
36	939015	0	0	0	0	0	0	0	1000	0	0	0	8	9
37	586712	0	0	0	0	0	0	0	1000	0	0	0	9	9
38	922283	0	0	0	0	0	0	0	1200	0	0	0	9	9
39	807222	0	0	0	0	0	0	0	1000	0	0	0	9	9
40	572547	0	0	0	3	0	0	18	1200	1	1	4	9	9
41	950072	0	0	0	3	0	0	18	1400	1	2	4	9	9
42	551197	0	0	0	2	0	0	12	1000	1	1	4	9	9
43	894117	0	0	0	0	0	0	0	1000	0	0	0	9	9
44	110700	0	0	0	2	0	0	12	1200	1	1	4	9	9
45	950213	0	0	0	0	0	0	0	1200	0	0	0	9	9
46	883360	0	0	0	0	0	0	0	900	0	0	0	9	9
47	965249	0	0	0	0	0	0	0	1000	0	0	0	8	9
48	965951	0	0	0	3	0	0	18	1200	1	1	4	9	9
49	924586	0	0	0	2	0	0	12	1000	1	1	4	9	9
50	970365	0	0	0	2	0	0	12	1200	1	2	4	9	9
51	407981	0	0	0	0	0	0	0	1000	0	0	0	9	9
52	972030	0	0	0	3	0	0	18	1600	1	1	4	9	9
53	926754	0	0	0	0	0	0	0	1200	0	0	0	9	9
54	837214	0	0	0	2	0	0	12	1000	1	1	4	9	9
55	974489	0	0	0	2	0	0	12	1000	0	0	0	9	9
56	997630	0	0	0	0	0	0	0	1200	0	0	0	9	9
57	1001869	0	0	0	2	0	0	12	800	1	1	4	8	9
58	963216	0	0	0	2	0	0	12	1000	1	1	4	8	9
59	1004851	0	0	0	0	0	0	0	1000	0	0	0	9	9
60	1004889	0	0	0	0	0	0	0	1200	0	0	0	9	9
61	568535	0	0	0	0	0	0	0	1200	0	0	0	9	9
62	1005973	0	0	0	0	0	0	0	1200	0	0	0	9	9
63	184774	0	0	0	0	0	0	0	1000	0	0	0	9	9
64	400414	0	0	0	0	0	0	0	1200	0	0	0	9	9
65	400414	0	0	0	1	0	0	6	1000	1	1	4	8	9
66	1021223	0	0	0	0	0	0	0	1000	0	0	0	9	9
67	823555	0	0	0	2	0	0	12	1200	1	1	4	8	8
68	1019413	0	0	0	0	0	0	0	800	0	0	0	9	9
69	1022162	0	0	0	0	0	0	0	1000	0	0	0	9	9
70	641704	0	0	0	2	0	0	12	900	0	0	0	9	9

Sr No.	MRD No.	AGE	HEIGHT	WEIGHT	BMI	Before_PI AT 1MIN	Before_PI AT 2MIN	Before_ PI AT 3 MIN	mean pi	Before_SBP AT 1 MIN	Before_SBP AT 2 MIN	Before_SBP AT 3 MIN	Before_MEAN OF THREE SBP	Before_DBP AT 1 MIN	Before_DBP AT 2 MIN	Before_DBP AT 3 MIN	Before_MAP AT 1 MIN	Before_MAP AT 2 MIN	Before_MAP AT 3 MIN	Before_HR AT 1 MIN	Before_HR AT 2 MIN	Before_HR AT 3 MIN	Before_SpO_2 AT 1 MIN	Before_SpO_2 AT 2 MIN
71	1022181	29	167	80	28.7	2.2	2.6	3.4	2.7	140	136	138	138	94	96	92	109	109	107	98	96	92	99	99
72	641704	32	157	75	30.4	4.5	5.2	4.5	4.7	126	136	122	128	82	64	76	96	88	91	83	82	84	99	98
73	942417	27	157	65	26.4	2.1	2	1.8	2.0	130	140	136	135	92	90	96	104	106	109	102	98	96	99	99
74	1024288	38	162.5	70	26.5	1.5	1.2	1.3	1.3	129	125	134	129	83	80	77	103	97	106	112	110	116	99	99
75	676762	32	154	73	30.8	3.4	3.6	3	3.3	124	126	130	126	80	86	78	94	99	95	84	86	82	98	98
76	816659	25	162.5	70	26.5	5.8	4.1	6.2	5.4	153	142	141	145	92	97	90	103	112	107	81	90	80	99	99
77	634471	27	162.5	65	24.6	7.4	7.8	6.1	7.1	120	128	130	126	65	68	70	83	88	90	92	94	96	99	99
78	1027239	36	162	80	30.5	2.2	2.4	2.8	2.5	140	132	134	135	76	82	86	97	99	102	96	98	92	98	99
79	1025580	23	162.5	65	24.6	1.4	1.2	1.6	1.4	116	120	122	119	79	74	76	93	92	91	78	82	86	99	99
80	1030324	25	162.5	70	26.5	1.9	1.7	2	1.9	124	135	118	125	79	77	79	94	96	92	92	90	86	99	99
81	229797	22	162.5	70	26.5	2.4	2.8	2.6	2.6	126	130	122	126	72	78	70	90	92	87	78	72	80	99	99
82	1027175	31	162.5	70	26.5	1.8	1.6	2.2	1.9	128	116	122	122	76	68	72	93	84	88	92	92	96	99	99
83	1033575	20	167.6	65	23.1	1.2	1.4	1.6	1.4	126	118	112	118	78	76	76	94	90	84	92	94	92	99	98
84	526465	35	157.4	70	28.2	3.5	3.8	4.2	3.8	126	118	120	121	72	62	68	90	80	85	102	100	106	99	99
85	255252	26	162.5	65	24.6	1.8	1.2	1.2	1.4	128	140	136	134	72	76	74	90	97	94	94	98	96	99	99
86	1031360	27	162.5	75	28.4	4.2	4.4	4.6	4.4	119	120	119	119	73	76	70	96	90	86	93	90	92	98	98
87	8093	37	157.4	70	28.2	3.2	3.4	3	3.2	113	120	116	118	68	72	64	84	88	81	92	90	88	99	99
88	905939	28	157.4	70	28.2	2.5	2.6	3.2	2.8	126	118	128	124	76	74	78	92	88	94	86	88	92	99	99
89	10375589	20	157	65	26.4	4.5	3.4	3	3.6	126	128	132	128	72	76	82	90	93	98	98	96	94	99	99
90	958946	25	162.5	80	30.3	2.8	2.6	2.4	2.6	128	132	124	128	88	90	84	101	104	97	96	92	88	99	98
91	872064	25	167.6	75	26.7	2	1.8	2.6	2.1	122	126	118	122	78	82	82	92	96	94	84	84	82	99	99
92	1041157	34	167.6	85	30.3	4	4.6	4.2	4.3	142	136	138	138	82	84	76	102	101	96	86	88	82	99	99
93	101402	35	157	70	28.4	6.2	6.4	7	6.5	128	126	126	126	84	80	76	92	95	92	74	76	72	98	98
94	104150	31	162	75	28.6	3.4	3	2.6	3.0	138	130	136	134	88	92	90	104	104	105	94	96	92	99	99
95	1041646	34	157	65	26.4	2.2	2.4	1.6	2.1	142	138	146	142	80	88	82	100	104	103	102	99	98	99	99
96	870343	25	167	80	28.7	5.2	5	5.2	5.1	126	120	124	123	82	74	76	96	89	92	86	86	82	99	99
97	1044230	29	152	68	29.4	6.4	6	6.6	6.3	118	126	128	124	66	74	68	83	91	88	72	72	76	98	98
98	1044162	29	167	85	30.5	2.6	2.4	3.4	2.8	142	136	134	137	86	92	82	104	106	99	98	98	96	99	99
99	1012898	30	154	68	28.7	6.2	6	5.6	5.9	112	122	108	114	90	84	88	97	96	94	82	86	82	99	99
100	202048	29	167	80	28.7	2.6	2.8	1.6	2.3	136	138	136	136	94	102	88	108	114	104	80	84	88	98	98
101	980056	27	157	75	30.4	3.6	4.2	3.8	3.9	120	126	118	121	98	96	86	105	102	96	102	102	100	98	98
102	1067771	30	170	88	30.4	1.2	1.6	1	1.3	136	130	122	129	88	92	88	104	104	99	96	92	92	99	99
103	1068651	27	152	68	29.4	2.8	2.6	3.4	2.9	118	122	116	118	88	94	92	103	103	100	96	96	94	98	98
104	423407	29	154	66	27.8	4.4	4.6	4	4.3	126	128	122	125	78	80	76	94	94	91	78	76	80	98	98
105	1076621	21	157	70	28.4	2.6	2.4	3.2	2.7	128	130	134	130	92	90	96	104	103	108	96	102	100	99	99
106	844157	23	162	78	29.7	4.5	4.2	4.4	4.4	138	130	136	134	98	94	88	111	106	104	106	102	102	99	99
107	1047592	29	157	75	28.6	6.2	6	6.6	6.3	130	134	126	130	86	90	82	100	104	96	84	82	82	98	98
108	1098167	28	165	80	29.4	3.5	3.2	3.4	3.4	130	128	134	130	82	86	94	98	100	107	88	94	92	99	98
109	893358	28	165	75	27.5	5.2	5	4.8	5.0	130	126	124	126	96	90	82	107	102	96	80	78	82	98	98
110	13527	28	165	74	27.2	4.4	4	3.6	4.0	130	118	116	121	78	82	80	95	94	92	80	78	78	98	98
111	1113309	24	162	78	29.7	2	2.6	2.4	2.3	126	122	130	126	82	86	88	96	98	102	90	94	94	98	98
112	972466	26	160	76	29	5	5	4.8	4.9	108	110	116	111	84	90	92	92	96	100	76	76	78	98	98
113	114130	28	154	72	30.4	4.2	4	3.8	4.0	138	140	138	138	90	96	92	106	110	107	82	82	84	98	98
114	520540	30	170	80	27.7	4.2	4	4.6	4.3	126	120	122	122	98	100	96	107	106	104	92	94	92	98	98
115	846978	22	154	70	29.5	2	2.4	2.2	2.2	130	128	120	126	90	90	82	103	102	94	96	96	92	99	99
116	1080077	28	157	75	30.4	3.4	3.4	3.4	3.4	120	118	122	120	92	96	94	101	103	103	86	86	84	98	98
117	886630	28	154	70	29.5	4.8	4.6	4.6	4.7	128	132	120	126	88	86	90	101	101	100	74	76	76	98	98
118	1006262	29	162	85	32.4	4.8	5.6	5.6	5.3	122	116	108	115	80	86	82	94	96	90	72	74	74	98	98
119	149351	35	157	70	28.4	6.2	6.6	6.2	6.3	120	124	130	124	88	92	94	98	102	106	76	78	80	98	98
120	992477	23	157	70	28.4	3.8	4.2	4	4.0	136	130	128	131	98	100	96	110	109	106	92	90	88	98	98

Sr No.	MRD No.	Before_SpO2 AT 3 MIN	After_PI AT 1 MIN	PI AT 2 MIN	PI AT 3 MIN	PI AT 4 MIN	PI AT 5 MIN	PI AT 6 MIN	PI AT 7 MIN	PI AT 8 MIN	PI AT 9 MIN	PI AT 10 MIN	PI AT 11 MIN	PI AT 12 MIN	SBP AT 1 MIN	SBP AT 2 MIN	SBP AT 3 MIN	SBP AT 4 MIN	SBP AT 5 MIN	SBP AT 6 MIN	SBP AT 7 MIN	SBP AT 8 MIN	SBP AT 9 MIN	SBP AT 10 MIN	SBP AT 11 MIN	SBP AT 12 MIN	DBP AT 1 MIN	DBP AT 2 MIN	DBP AT 3 MIN	DBP AT 4 MIN	DBP AT 5 MIN	DBP AT 6 MIN	DBP AT 7 MIN	DBP AT 8 MIN
71	1022181	99	3.4	3.5	3.6	2.8	2.2	2	1.6	1.2	-	-	-	-	132	128	132	126	122	126	128	136	-	-	-	-	68	76	82	80	68	76	74	88
72	641704	98	5.2	5.2	4.5	3.5	2.8	2.6	1.8	2.8	-	-	-	-	122	116	102	100	112	118	126	122	-	-	-	-	62	64	62	56	68	62	72	64
73	942417	99	2.5	2.2	3.2	3.2	3	2.5	2.2	-	-	-	-	-	136	128	126	124	128	136	130	-	-	-	-	-	82	72	64	68	72	78	78	-
74	1024288	99	1.1	1.2	1.2	1.6	1.3	1.4	-	-	-	-	-	-	120	133	125	108	112	120	-	-	-	-	-	-	72	69	54	66	62	68	-	-
75	676762	98	3.2	3.4	3.6	2.8	2.6	2.4	2.6	2.4	2.2	2	2.4	-	126	110	98	110	116	112	118	120	116	124	118	-	82	68	52	64	70	68	64	66
76	816659	98	8.1	8.3	7.7	6.5	6.3	5.1	6.1	-	-	-	-	-	152	131	130	130	136	137	126	-	-	-	-	-	94	77	70	72	72	74	73	-
77	634471	99	6.5	6.6	6.8	7.2	7	7.4	6.5	-	-	-	-	-	135	120	118	108	100	106	110	-	-	-	-	-	70	72	56	62	57	60	60	-
78	1027239	99	2.4	2.6	2.6	2.8	2.4	2	-	-	-	-	-	-	132	122	120	110	116	126	-	-	-	-	-	-	76	68	62	60	66	70	-	-
79	1025580	99	1.1	1.1	1.2	1.2	1.4	-	-	-	-	-	-	-	121	119	117	118	103	-	-	-	-	-	-	-	78	74	62	60	64	-	-	-
80	1030324	99	4.2	4.5	3	3.5	3.2	-	-	-	-	-	-	-	128	125	125	120	116	-	-	-	-	-	-	-	74	76	70	80	72	-	-	-
81	229797	99	1.6	1.8	2.2	1.6	1.8	2	2.2	2	1.6	1.8	1.2	1.4	130	126	116	110	114	120	122	126	124	118	124	120	74	70	64	62	68	72	76	70
82	1027175	99	2.2	1.8	1.6	1.6	1.8	1.2	-	-	-	-	-	-	122	116	120	126	122	120	-	-	-	-	-	-	72	68	70	76	72	68	-	-
83	1033575	99	1.2	1.4	1.6	2.2	2	1.6	-	-	-	-	-	-	110	112	116	112	120	116	-	-	-	-	-	-	62	64	62	66	72	68	-	-
84	526465	99	4.6	5.2	5.6	5.4	4.2	4.6	4	3.6	3.8	-	-	-	118	106	98	90	106	110	116	114	120	-	-	-	64	60	52	48	52	58	60	58
85	255252	99	1.8	2.1	2.3	3.2	4.3	4.2	-	-	-	-	-	-	128	114	111	102	110	118	-	-	-	-	-	-	72	62	55	48	54	58	-	-
86	1031360	98	5.7	6.2	6.2	6.2	6	5.6	-	-	-	-	-	-	116	104	111	101	97	102	-	-	-	-	-	-	62	58	66	65	61	66	-	-
87	8093	99	3.4	3.2	2.6	3.4	2.8	2.6	-	-	-	-	-	-	116	108	106	116	120	112	-	-	-	-	-	-	56	52	50	56	62	64	-	-
88	905939	99	3	2.6	2.8	3.2	3	2.6	1.8	2	-	-	-	-	126	100	96	108	120	116	126	122	-	-	-	-	72	64	60	62	64	60	68	64
89	10375589	99	3.2	3.5	3.6	3	2.5	2.4	2.4	2	-	-	-	-	130	126	122	118	116	122	136	130	-	-	-	-	78	72	68	64	62	78	84	86
90	958946	98	2.4	3.4	3.6	3.2	3	2.8	2.8	3	2.4	2.6	2	-	122	118	116	108	106	130	126	122	128	124	126	-	64	60	62	56	74	80	66	62
91	872064	99	2.8	3.6	3.8	4	3.5	3.2	3	2.8	-	-	-	-	132	126	122	118	116	120	122	124	-	-	-	-	80	78	76	62	66	64	72	82
92	1041157	99	4	4.2	3.8	4.4	4.2	4.6	4.2	-	-	-	-	-	140	132	124	126	118	122	120	-	-	-	-	-	82	84	82	76	68	62	66	-
93	101402	98	8.2	7.4	6.2	6.6	5.6	5.2	5.4	-	-	-	-	-	120	118	122	126	116	124	120	-	-	-	-	-	76	58	68	66	62	70	68	-
94	104150	99	3.2	3.6	2.8	3.2	3	3.6	3.2	2.2	2.6	-	-	-	136	126	116	118	122	110	116	118	122	-	-	-	76	64	62	60	64	52	58	56
95	1041646	99	1.8	2	2.4	2.6	2.2	3	3	-	-	-	-	-	136	126	120	122	120	126	122	-	-	-	-	-	88	76	72	74	70	72	82	-
96	870343	99	5.2	5	5.6	5.8	4.8	4.2	4.6	-	-	-	-	-	116	102	88	92	106	112	126	-	-	-	-	-	68	52	48	54	62	60	68	-
97	1044230	98	6.6	6.8	6.4	6.2	6	5.2	5.6	5.2	5.8	5	-	-	126	116	110	112	120	106	110	112	120	118	-	-	74	68	66	62	64	62	58	60
98	1044162	99	3.6	3.4	4	4	3.8	3.8	4.4	-	-	-	-	-	130	126	102	106	110	116	120	-	-	-	-	-	82	76	68	60	56	60	66	-
99	1012898	99	5.2	5	4.8	5	4.6	4	-	-	-	-	-	-	106	82	98	112	110	122	-	-	-	-	-	-	78	46	52	60	56	60	-	-
100	202048	97	2.6	2.6	2.8	2.4	2	2.4	1.6	1.8	1.8	1.6	1.4	-	140	118	120	116	124	122	128	130	128	120	124	-	92	79	76	72	76	84	82	82
101	980056	98	3.8	3.2	3	3.2	2.8	-	-	-	-	-	-	-	108	92	106	112	110	-	-	-	-	-	-	-	84	56	78	80	76	-	-	-
102	1067771	99	1.6	1.8	2.4	2.2	2.6	1.8	1.8	1.8	1.2	1	1.2	-	140	136	122	120	126	124	130	136	132	128	124	-	96	80	76	74	78	84	86	84
103	1068651	98	3.6	3.4	3	3	2.6	1.8	1.6	1	-	-	-	-	118	106	110	116	118	126	124	120	-	-	-	-	86	64	68	64	76	78	82	76
104	423407	98	4.2	5.6	6.2	6	5.6	5.8	5.4	5.9	4.8	5.2	-	-	122	120	118	122	120	128	124	120	122	128	-	-	78	76	68	68	74	72	74	68
105	1076621	99	3.6	3.4	3.4	3.4	3.8	3	-	-	-	-	-	-	122	102	100	108	110	122	-	-	-	-	-	-	92	82	65	70	78	72	-	-
106	844157	99	4	4	3.8	4.2	5.2	5.4	5	4	-	-	-	-	136	130	126	120	124	120	118	126	-	-	-	-	96	88	88	82	78	78	82	84
107	1047592	98	6.4	6.8	7	6.4	6	5.6	5.6	5	4.8	5	-	-	126	104	94	108	116	120	118	124	126	130	-	-	82	76	52	68	62	72	68	74
108	1098167	98	3.2	3	2.8	2.6	2.5	2.8	-	-	-	-	-	-	128	116	118	110	124	122	-	-	-	-	-	-	74	64	66	68	72	86	-	-
109	893358	98	4.8	5.6	5.4	5.2	5	4.2	4	-	-	-	-	-	126	120	116	108	110	116	124	-	-	-	-	-	78	66	68	62	68	70	76	-
110	13527	98	3.8	4	3.6	3.8	4	3.2	3.6	3.4	3.2	3	-	-	110	102	96	96	106	116	112	118	120	122	-	-	78	66	44	58	62	66	70	72
111	1113309	98	2.6	2.4	3.2	3	3	2.8	-	-	-	-	-	-	122	116	110	116	118	116	-	-	-	-	-	-	72	66	68	76	76	82	-	-
112	972466	98	4.8	5	4.6	4.8	5	5	-	-	-	-	-	-	106	102	78	88	106	110	-	-	-	-	-	-	68	58	47	56	64	68	-	-
113	114130	98	3.6	3.8	4	4.2	3.6	3.4	3.4	3	3.4	3.2	2.6	2.2	136	120	106	116	120	122	126	122	130	120	124	119	92	88	76	72	76	78	76	72
114	520540	98	4	3.8	4.2	4	4	3.8	3.6	3.4	3.2	2.8	-	-	120	116	120	122	120	122	124	120	128	130	-	-	90	88	86	88	82	84	80	78
115	846978	99	2.6	3	3.2	3	3.2	3.4	3	-	-	-	-	-	116	110	116	120	124	120	122	-	-	-	-	-	82	80	68	74	76	72	78	-
116	1080077	98	3.6	3.8	4	3.6	3.8	3.4	-	-	-	-	-	-	112	110	106	112	114	118	-	-	-	-	-	-	92	98	82	76	78	74	-	-
117	886630	98	4.6	4.8	5	4.2	4.6	4	3.6	3.4	3	3.5	3.2	3	116	102	84	98	110	118	124	120	119	124	126	128	86	72	60	58	62	68	70	68
118	1006262	98	5.6	5.4	5	5.2	5	5	4.8	4.2	-	-	-	-	110	102	106	112	116	110	114	116	-	-	-	-	80	76	68	74	76	72	74	72
119	149351	98	6.6	6.8	7	6.4	6.2	-	-	-	-	-	-	-	110	92	108	106	112	-	-	-	-	-	-	-	78	64	74	72	78	-	-	-
120	992477	98	4.2	4.6	4	4.4	3.5	3.6	3.8	3.4	3.5	3	3.6	-	116	110	102	108	118	128	124	130	122	120	124	-	80	72	70	68	76	74	70	68

Sr No.	MRD No.	DBP AT 9 MIN	DBP AT 10 MIN	DBP AT 11 MIN	DBP AT 12 MIN	MAP AT 1 MIN	MAP AT 2 MIN	MAP AT 3 MIN	MAP AT 4 MIN	MAP AT 5 MIN	MAP AT 6 MIN	MAP AT 7 MIN	MAP AT 8 MIN	MAP AT 9 MIN	MAP AT 10 MIN	MAP AT 11 MIN	MAP AT 12 MIN	HR AT 1 MIN	HR AT 2 MIN	HR AT 3 MIN	HR AT 4 MIN	HR AT 5 MIN	HR AT 6 MIN	HR AT 7 MIN	HR AT 8 MIN	HR AT 9 MIN	HR AT 10 MIN	HR AT 11 MIN	HR AT 12 MIN	SpO_2 AT 1 MIN	SpO_2 AT 2 MIN	SpO_2 AT 3 MIN
71	1022181	-	-	-	-	89.3	93.3	98.7	95.3	86.0	92.7	92.0	104.0	-	-	-	-	92	96	98	102	100	98	96	92	-	-	-	-	99	99	99
72	641704	-	-	-	-	82.0	81.3	75.3	70.7	82.7	80.7	90.0	83.3	-	-	-	-	97	91	93	95	85	81	85	85	-	-	-	-	98	97	97
73	942417	-	-	-	-	100.0	90.7	84.7	86.7	90.7	97.3	95.3	-	-	-	-	-	98	96	92	88	88	88	92	-	-	-	-	-	99	99	99
74	1024288	-	-	-	-	88.0	90.3	77.7	80.0	78.7	85.3	-	-	-	-	-	-	114	106	102	98	92	99	-	-	-	-	-	-	99	99	99
75	676762	62	68	70	-	96.7	82.0	67.3	79.3	85.3	82.7	82.0	84.0	80.0	86.7	86.0	-	82	78	72	74	76	76	78	-	-	-	-	-	98	98	98
76	816659	-	-	-	-	113.3	95.0	90.0	91.3	93.3	95.0	90.7	-	-	-	-	-	91	91	103	107	106	111	109	-	-	-	-	-	100	100	100
77	634471	-	-	-	-	91.7	88.0	76.7	77.3	71.3	75.3	76.7	-	-	-	-	-	97	97	99	95	101	103	105	-	-	-	-	-	99	99	99
78	1027239	-	-	-	-	94.7	86.0	81.3	76.7	82.7	88.7	-	-	-	-	-	-	92	94	90	88	90	92	-	-	-	-	-	-	98	98	98
79	1025580	-	-	-	-	92.3	89.0	80.3	79.3	77.0	-	-	-	-	-	-	-	88	82	90	82	76	-	-	-	-	-	-	-	99	99	99
80	1030324	-	-	-	-	92.0	92.3	88.3	93.3	86.7	-	-	-	-	-	-	-	82	80	84	82	86	-	-	-	-	-	-	-	99	99	99
81	229797	72	68	76	70	92.7	88.7	81.3	78.0	83.3	88.0	91.3	88.7	89.3	84.7	92.0	86.7	80	82	84	82	83	82	86	87	86	84	85	86	99	99	99
82	1027175	-	-	-	-	88.7	84.0	86.7	92.7	88.7	85.3	-	-	-	-	-	-	92	88	82	86	88	82	-	-	-	-	-	-	99	99	99
83	1033575	-	-	-	-	78.0	80.0	80.0	81.3	88.0	84.0	-	-	-	-	-	-	92	96	98	90	82	88	-	-	-	-	-	-	99	99	99
84	526465	62	-	-	-	82.0	75.3	67.3	62.0	70.0	75.3	78.7	76.7	81.3	-	-	-	113	111	115	109	107	107	105	103	101	-	-	-	99	99	99
85	255252	-	-	-	-	90.7	79.3	73.7	66.0	72.7	78.0	-	-	-	-	-	-	106	108	102	98	96	100	-	-	-	-	-	-	99	99	99
86	1031360	-	-	-	-	80.0	73.3	81.0	77.0	73.0	78.0	-	-	-	-	-	-	93	91	93	94	93	97	-	-	-	-	-	-	99	99	99
87	8093	-	-	-	-	76.0	70.7	68.7	76.0	81.3	80.0	-	-	-	-	-	-	88	92	90	86	82	84	-	-	-	-	-	-	99	99	99
88	905939	-	-	-	-	90.0	76.0	72.0	77.3	82.7	78.7	87.3	83.3	-	-	-	-	92	96	90	88	82	84	80	78	-	-	-	-	99	99	99
89	10375589	-	-	-	-	95.3	90.0	86.0	82.0	80.0	92.7	101.3	100.7	-	-	-	-	92	88	84	76	78	74	78	82	-	-	-	-	99	99	99
90	958946	68	70	68	-	83.3	79.3	80.0	73.3	84.7	96.7	86.0	82.0	88.0	88.0	87.3	-	92	96	98	94	92	90	88	84	84	83	82	-	99	99	99
91	872064	-	-	-	-	97.3	94.0	91.3	80.7	82.7	82.7	88.7	96.0	-	-	-	-	82	84	76	72	74	74	74	76	-	-	-	-	99	99	99
92	1041157	-	-	-	-	101.3	100.0	96.0	92.7	84.7	82.0	84.0	-	-	-	-	-	91	91	85	87	83	85	85	-	-	-	-	-	99	98	99
93	101402	-	-	-	-	90.7	78.0	86.0	86.0	80.0	88.0	85.3	-	-	-	-	-	77	85	87	89	87	87	83	-	-	-	-	-	98	98	98
94	104150	60	-	-	-	96.0	84.7	80.0	79.3	83.3	71.3	77.3	76.7	80.7	-	-	-	96	92	94	88	88	86	86	86	84	-	-	-	99	99	99
95	1041646	-	-	-	-	104.0	92.7	88.0	90.0	86.7	90.0	95.3	-	-	-	-	-	96	92	90	88	88	86	88	-	-	-	-	-	99	99	99
96	870343	-	-	-	-	84.0	68.7	61.3	66.7	76.7	77.3	87.3	-	-	-	-	-	91	97	89	85	71	77	81	-	-	-	-	-	99	99	99
97	1044230	64	62	-	-	91.3	84.0	80.7	78.7	82.7	76.7	75.3	77.3	82.7	80.7	-	-	77	77	77	79	79	81	79	77	77	74	-	-	98	98	98
98	1044162	-	-	-	-	98.0	92.7	79.3	75.3	74.0	78.7	84.0	-	-	-	-	-	96	90	80	76	78	80	82	-	-	-	-	-	98	98	98
99	1012898	-	-	-	-	87.3	58.0	67.3	77.3	74.0	80.7	-	-	-	-	-	-	95	101	101	105	101	98	-	-	-	-	-	-	99	99	99
100	202048	80	78	76	-	108.0	92.0	90.7	86.7	92.0	96.7	97.3	98.0	96.0	92.0	92.0	-	88	86	90	90	88	88	84	86	85	84	86	-	97	97	97
101	980056	-	-	-	-	92.0	68.0	87.3	90.7	87.3	-	-	-	-	-	-	-	103	95	91	93	95	9	-	-	-	-	-	-	98	98	98
102	1067771	90	88	86	-	110.7	98.7	91.3	89.3	94.0	97.3	100.7	101.3	104.0	101.3	98.7	-	92	98	94	96	92	90	88	82	84	82	86	-	99	99	99
103	1068651	-	-	-	-	96.7	78.0	82.0	81.3	90.0	94.0	96.0	90.7	-	-	-	-	96	98	102	100	92	94	94	90	-	-	-	-	98	98	98
104	423407	76	72	-	-	92.7	90.7	84.7	86.0	89.3	90.7	90.7	85.3	91.3	90.7	-	-	85	87	85	87	87	81	81	81	77	72	-	-	98	98	98
105	1076621	-	-	-	-	102.0	88.7	76.7	82.7	88.7	88.7	-	-	-	-	-	-	104	102	96	88	88	92	-	-	-	-	-	-	98	97	97
106	844157	-	-	-	-	109.3	102.0	100.7	94.7	93.3	92.0	94.0	98.0	-	-	-	-	109	109	107	105	107	101	101	97	-	-	-	-	99	99	99
107	1047592	72	70	-	-	96.7	85.3	66.0	81.3	80.0	88.0	84.7	90.7	90.0	90.0	-	-	95	91	87	81	83	85	83	81	79	75	-	-	98	97	97
108	1098167	-	-	-	-	92.0	81.3	83.3	82.0	89.3	98.0	-	-	-	-	-	-	92	90	88	84	82	86	-	-	-	-	-	-	98	98	98
109	893358	-	-	-	-	94.0	84.0	84.0	77.3	82.0	85.3	92.0	-	-	-	-	-	85	87	87	85	85	87	85	-	-	-	-	-	98	98	98
110	13527	68	70	-	-	88.7	78.0	61.3	70.7	76.7	82.7	84.0	87.3	85.3	87.3	-	-	83	89	85	81	79	83	83	79	79	74	-	-	98	97	97
111	1113309	-	-	-	-	88.7	82.7	82.0	89.3	90.0	93.3	-	-	-	-	-	-	94	92	90	90	92	90	-	-	-	-	-	-	98	98	98
112	972466	-	-	-	-	80.7	72.7	57.3	66.7	78.0	82.0	-	-	-	-	-	-	77	77	73	71	75	77	-	-	-	-	-	-	98	97	97
113	114130	74	68	78	72	106.7	98.7	86.0	86.7	90.7	92.7	92.7	88.7	92.7	85.3	93.3	87.7	87	91	89	87	87	89	85	85	83	76	75	75	97	97	97
114	520540	84	76	-	-	100.0	97.3	97.3	99.3	94.7	96.7	94.7	92.0	98.7	94.0	-	-	95	101	99	101	101	99	103	102	99	94	-	-	98	98	98
115	846978	-	-	-	-	93.3	90.0	84.0	89.3	92.0	88.0	92.7	-	-	-	-	-	90	90	92	88	90	90	94	-	-	-	-	-	99	99	99
116	1080077	-	-	-	-	98.7	102.0	90.0	88.0	90.0	88.7	-	-	-	-	-	-	82	84	80	82	80	78	-	-	-	-	-	-	99	99	99
117	886630	72	70	76	70	96.0	82.0	68.0	71.3	78.0	84.7	88.0	85.3	87.7	88.0	92.7	89.3	85	85	79	77	83	77	77	77	77	74	72	74	98	97	97
118	1006262	-	-	-	-	90.0	84.7	80.7	86.7	89.3	84.7	87.3	86.7	-	-	-	-	75	77	83	81	81	85	81	81	-	-	-	-	98	98	98
119	149351	-	-	-	-	88.7	73.3	85.3	83.3	89.3	-	-	-	-	-	-	-	73	73	75	77	79	9	-	-	-	-	-	-	98	97	97
120	992477	76	74	78	-	92.0	84.7	80.7	81.3	90.0	92.0	88.0	88.7	91.3	89.3	93.3	-	91	89	87	91	93	91	91	91	87	83	84	-	98	98	98

Sr No.	MRD No.	SpO_2 AT 4 MIN	SpO_2 AT 5 MIN	SpO_2 AT 6 MIN	SpO_2 AT 7 MIN	SpO_2 AT 8 MIN	SpO2 AT 9 MIN	SpO2AT 10 MIN	SpO2AT 11 MIN	SpO2AT 12 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 1 MIN	BOLUSES OF VASOPRESSORS(IF USED) AT 2 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 3 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 4 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 5 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 6 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 7 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT 8 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT9 MIN
71	1022181	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
72	641704	97	97	98	98	98	-	-	-	-	0	0	6	6	0	0	0	0	0
73	942417	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
74	1024288	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
75	676762	98	98	98	98	98	98	98	98	-	0	0	6	0	0	0	0	0	0
76	816659	100	100	100	100	-	-	-	-	-	0	0	0	0	0	0	0	0	0
77	634471	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
78	1027239	98	98	98	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
79	1025580	99	99	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
80	1030324	99	99	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
81	229797	99	99	99	99	99	99	99	99	99	0	0	0	0	0	0	0	0	0
82	1027175	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
83	1033575	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
84	526465	99	99	99	99	99	99	-	-	-	0	0	0	0	6	0	0	0	0
85	255252	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
86	1031360	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
87	8093	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
88	905939	99	99	99	99	99	-	-	-	-	0	0	6	6	0	0	0	0	0
89	10375589	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
90	958946	99	99	99	99	99	99	99	99	-	0	0	0	0	0	0	0	0	0
91	872064	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
92	1041157	98	98	98	98	98	-	-	-	-	0	0	0	0	0	0	0	0	0
93	101402	98	98	98	98	-	-	-	-	-	0	0	0	0	0	0	0	0	0
94	104150	99	99	99	99	99	99	-	-	-	0	0	0	0	0	0	0	0	0
95	1041646	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
96	870343	99	99	99	99	-	-	-	-	-	0	6	6	0	0	0	0	0	0
97	1044230	98	98	98	98	98	98	98	-	-	0	0	0	0	0	0	0	0	0
98	1044162	98	99	99	98	-	-	-	-	-	0	6	6	6	0	0	0	0	0
99	1012898	99	99	99	-	-	-	-	-	-	0	6	0	0	0	0	0	0	0
100	202048	98	98	-	98	98	98	98	98	-	0	0	0	0	0	0	0	0	0
101	980056	98	98	-	-	-	-	-	-	-	0	6	0	0	0	0	0	0	0
102	1067771	99	99	99	99	99	99	99	99	-	0	0	0	0	0	0	0	0	0
103	1068651	98	98	98	98	98	-	-	-	-	0	0	0	0	0	0	0	0	0
104	423407	98	98	98	98	98	98	98	-	-	0	0	0	0	0	0	0	0	0
105	1076621	97	97	97	-	-	-	-	-	-	0	6	6	0	0	0	0	0	0
106	844157	99	99	99	99	99	-	-	-	-	0	0	0	0	0	0	0	0	0
107	1047592	97	97	97	98	98	98	98	-	-	0	6	6	0	0	0	0	0	0
108	1098167	98	98	98	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
109	893358	98	98	98	98	-	-	-	-	-	0	0	0	0	0	0	0	0	0
110	13527	97	97	97	97	97	97	97	-	-	0	0	6	6	0	0	0	0	0
111	1113309	98	98	98	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
112	972466	97	97	97	-	-	-	-	-	-	0	0	6	6	0	0	0	0	0
113	114130	98	98	98	98	98	98	98	98	98	0	0	6	0	0	0	0	0	0
114	520540	98	98	98	98	98	98	98	-	-	0	0	0	0	0	0	0	0	0
115	846978	99	99	99	99	-	-	-	-	-	0	0	0	0	0	0	0	0	0
116	1080077	99	99	99	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
117	886630	97	97	97	97	97	97	97	97	97	6	0	6	6	6	0	0	0	0
118	1006262	98	98	98	98	98	-	-	-	-	0	0	0	0	0	0	0	0	0
119	149351	97	98	-	-	-	-	-	-	-	0	6	0	0	0	0	0	0	0
120	992477	98	98	98	98	98	98	98	98	-	0	0	6	0	0	0	0	0	0

Sr No.	MRD No.	1BOLUSES OF VASOPRESSORS (IF USED) AT10 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT11 MIN	BOLUSES OF VASOPRESSORS (IF USED) AT12 MIN	EPISODES OF HYPOTENSION(SBP DECREASE TO LESS THAN EQUAL TO 80% OF BASELINE)	EPISODES OF BRADYCARDIA (HR< 60 PER MIN)	DOSE OF ATROPINE(MG) ADMINISTERED)	DOSE OF EPHEDRINE (MG) ADMINISTERED	AMOUNT OF CRYSTALLOID(ML) USED	EPISODES OF IONV	GRADING	INTERVENTION (DOSE OF ONDANSETRON(MG)) ADMINISTERED	APGAR SCORE AT 1 MIN	APGAR SCORE AT 5 MIN
71	1022181	0	0	0	0	0	0	0	1200	0	0	0	9	9
72	641704	0	0	0	2	0	0	12	800	1	1	4	9	9
73	942417	0	0	0	0	0	0	0	1000	0	0	0	9	9
74	1024288	0	0	0	0	0	0	0	800	0	0	0	9	9
75	676762	0	0	0	1	0	0	6	900	1	1	4	8	9
76	816659	0	0	0	0	0	0	0	1200	0	0	0	9	9
77	634471	0	0	0	0	0	0	0	1000	0	0	0	9	9
78	1027239	0	0	0	0	0	0	0	1000	0	0	0	9	9
79	1025580	0	0	0	0	0	0	0	1000	0	0	0	9	9
80	1030324	0	0	0	0	0	0	0	800	0	0	0	8	9
81	229797	0	0	0	0	0	0	0	1000	0	0	0	9	9
82	1027175	0	0	0	0	0	0	0	1000	0	0	0	7	9
83	1033575	0	0	0	0	0	0	0	1200	0	0	0	9	9
84	526465	0	0	0	1	0	0	6	1000	1	1	4	9	9
85	255252	0	0	0	0	0	0	0	1100	0	0	0	9	9
86	1031360	0	0	0	0	0	0	0	900	1	1	4	9	9
87	8093	0	0	0	0	0	0	0	1000	0	0	0	9	9
88	905939	0	0	0	2	0	0	12	1100	0	0	0	9	9
89	10375589	0	0	0	0	0	0	0	1200	0	0	0	9	9
90	958946	0	0	0	0	0	0	0	1100	0	0	0	8	9
91	872064	0	0	0	0	0	0	0	1000	0	0	0	9	9
92	1041157	0	0	0	0	0	0	0	1000	0	0	0	9	9
93	101402	0	0	0	0	0	0	0	1000	0	0	0	9	9
94	104150	0	0	0	0	0	0	0	1000	0	0	0	9	9
95	1041646	0	0	0	0	0	0	0	1100	0	0	0	9	9
96	870343	0	0	0	2	0	0	12	1200	1	2	4	9	9
97	1044230	0	0	0	0	0	0	0	1000	0	0	0	9	9
98	1044162	0	0	0	3	0	0	18	1000	1	1	4	8	9
99	1012898	0	0	0	1	0	0	6	1100	1	1	4	8	9
100	202048	0	0	0	0	0	0	0	1200	0	0	0	9	9
101	980056	0	0	0	1	0	0	6	1000	0	0	0	8	8
102	1067771	0	0	0	0	0	0	0	1100	0	0	0	9	9
103	1068651	0	0	0	0	0	0	0	1000	0	0	0	9	9
104	423407	0	0	0	0	0	0	0	1000	0	0	0	8	9
105	1076621	0	0	0	2	0	0	12	1100	1	2	4	8	9
106	844157	0	0	0	0	0	0	0	1000	0	0	0	9	9
107	1047592	0	0	0	2	0	0	12	1000	1	1	4	8	9
108	1098167	0	0	0	0	0	0	0	1100	0	0	0	9	9
109	893358	0	0	0	0	0	0	0	1100	0	0	0	8	9
110	13527	0	0	0	2	0	0	12	1000	1	2	4	8	9
111	1113309	0	0	0	0	0	0	0	1000	0	0	0	9	9
112	972466	0	0	0	2	0	0	12	1100	1	2	4	8	9
113	114130	0	0	0	1	0	0	6	1000	1	1	4	9	9
114	520540	0	0	0	0	0	0	0	1000	0	0	0	9	9
115	846978	0	0	0	0	0	0	0	1100	0	0	0	9	9
116	1080077	0	0	0	0	0	0	0	1000	0	0	0	9	9
117	886630	0	0	0	4	0	0	24	1000	1	1	4	8	9
118	1006262	0	0	0	0	0	0	0	1000	0	0	0	8	9
119	149351	0	0	0	1	0	0	6	900	0	0	0	9	9
120	992477	0	0	0	1	0	0	6	1000	1	1	4	9	9

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Date 20/01/2021

The Principal
DMCH, Ludhiana

Subject: Approval of Plan of Thesis

This is to inform you that the Faculty of Medical Sciences in its meeting held on 22.01.2021 has approved the plan of thesis of **Dr. Sandeep Singh**, a student of your college for **MD Anaesthesiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Perfusion index as a tool to evaluate the incidence of hypotension during subarachnoid block for lower segment caesarean section

Supervisor
Dr. Neeru Luthra
Assoc. Prof.,
Dept. of Anaesthesiology,
DMCH, Ludhiana.

Co-Supervisor
Dr. Namrata
Assoc. Prof.,
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Dr. Anju Grewal
Prof.,
Dept. of Anathesiology,
DMCH, Ludhiana.

The student has to submit the three copies of thesis (along with PDF format), to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic(s) if any).

SPSingh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note:

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e. for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE

In

ANAESTHESIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

NOVEMBER 2019

DR. SANDEEP SINGH

DEPARTMENT OF ANAESTHESIOLOGY
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
LUDHIANA, PUNJAB-141001

ABSTRACT OF PLAN OF THESIS

Title	PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESEREAN SECTION
For the degree of	M.D. Anaesthesia
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Introduction: Perfusion Index (PI) can be used to assess peripheral perfusion dynamics as it depicts the changes in peripheral vascular tone. Parturients with higher baseline PI have been reported to have lower peripheral vascular resistance and hence are at a higher risk of developing hypotension following SAB. We proposed to evaluate PI as a non-invasive tool for predicting incidence and severity of maternal hypotension following SAB in parturients undergoing lower segment caesarean section(LSCS).

Aim of Study: To evaluate the correlation of PI and SAB induced hypotension in LSCS.

Materials & Methods: A prospective, randomized observational study will be conducted on 120 ASA-II parturients undergoing LSCS under SAB. Systolic Blood Pressure (SBP), Mean Arterial Pressure (MAP), and PI will be recorded at baseline. The recordings will be done at one minute interval till the delivery of baby. The data thus collected will analysed statistically.

Clinical Significance: This study will focus on evaluating the use of PI in predicting incidence and severity of SAB induced maternal hypotension.

Keywords: Perfusion Index (PI), Subarachnoid block (SAB), Hypotension, lower segment caesarean section (LSCS).

(Signature) Candidate	(Signature) Co-supervisor	(Signature) Co-supervisor	(Signature) Supervisor	(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION"** exist in the Department of Anaesthesiology at Dayanand Medical College and Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

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6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Subarachnoid block (SAB) is an anaesthetic technique of choice for lower segment caesarean section (LSCS). However the reported incidence of the SAB induced hypotension is around 70-80%.[1,2] Hypotension during SAB for LSCS is associated with significant maternal complications such as nausea, vomiting and decrease in utero-placental blood flow, foetal acidosis and rarely, maternal cardio-vascular collapse.[3] Physiological changes of pregnancy lead to decrease in peripheral vascular tone and trapping of blood volume in the extremities even before the institution of SAB, which gets aggravated following onset of a sympathetic block. Parturients are more sensitive to local anaesthetics, less responsive to vasopressors and have lower mean arterial pressure (MAP) at term.[4] The standard method of monitoring intra operative hemodynamics is by non invasive blood pressure (NIBP). However this method does not measure beat to beat variation in hemodynamics. A non-invasive modality of measuring peripheral vascular tone is measurement of Perfusion Index (PI) which can be done using a pulse oximeter.[5] The principle is similar to that of peripheral oxygen saturation (SpO_2) which is based on two light sources of different wavelengths (660 nm and 940 nm) which are emitted through cutaneous vascular bed. Both wavelengths have a pulsatile component representing the fluctuation, as pulsations of the arterial blood and nonpulsatile component from connective tissue, bone and the venous component. PI is the ratio of this pulsatile and the nonpulsatile component of light reaching the detector.[5,6]

PI can be used to assess peripheral perfusion dynamics due to changes in peripheral vascular tone and can be used to detect the likelihood of development of hypotension following SAB.[7] Normal pregnancy is associated with a decrease in systemic vascular resistance (SVR). Vasodilatation (decrease in the peripheral vascular tone) leads to increased pulsatile component and corresponds to higher PI values.[8] Hence, parturients having higher baseline PI values

have lower peripheral vascular tone and are at a higher risk of experiencing hypotension after SAB.[6]

Toyama et al in their study on 39 parturients for LSCS used PI to predict incidence of hypotension under SAB. The investigators observed an association of a higher baseline PI (>3.5) with profound hypotension, thereby concluding that baseline PI could predict incidence of SAB induced hypotension. In another study, parturients were divided into two groups based on PI value <3.5 and >3.5.This study found a significant correlation between baseline PI>3.5 and number of episodes of hypotension.[5-8]

The use of PI can aid in the assessment of baseline vascular tone and volume status and thus serve as a non-invasive tool for prediction of severity of hypotension following SAB in pregnant women. Due to paucity of studies validating this tool in the above context we propose to evaluate the correlation of PI with SAB induced hypotension in parturients undergoing LSCS.

6.2REVIEW OF LITERATURE

SAB induced hypotension complicates up to 80% of spinal anaesthetics administered for scheduled LSCS. It leads to placental hypoperfusion with subsequent fetal hypoxia, acidosis and neurological injury. Several strategies for prevention and treatment have been described but there appears to be no consensus on which of these is most effective.[3]

Holmes et al[9] and Lees et al[10] attributed SAB induced hypotension to compression of the vena cava by gravid uterus which impedes the venous return (VR) along with venous pooling of blood in lower limbs, leading to decreased VR, fall in cardiac output (CO) and hypotension. Marx[11] suggested that neuraxial blockade resulted in venous pooling of blood in lower limbs, leading to decreased venous return (VR) and fall in cardiac output (CO). Hence intra-venous fluid administration including crystalloid co-loading were recommended to prevent maternal hypotension following SAB.

Genderen et al[12] investigated the role of PI to detect the progressive reductions in central blood volume in healthy volunteers. It was acheived by inducing stepwise lower body negative pressure by with 20 mmHg for 5 minutes per step. Stroke volume (SV), Heart rate (HR), mean arterial pressure (MAP) were also recorded using volume clamp finger plethysmography. Assessment of Peripheral Perfusion Index (PPI) was done by pulse oximetry. The magnitude of PPI decreased statistically different from that observed for SV and HR. PPI remained low throughout the reminder of protocol. They found it to be a diagnostic tool which could detect early clinically significant central hypovolemia, before the onset of cardiovascular decompensation. Thus the pulse oximeter derived PPI can be a valuable adjunct for detecting acute hemodynamic changes due to hypovolemia even before onset of cardiovascular decompensation in varied variety of clinical settings.

Lima et al[13] found that perfusion index can reflect clinical signs of decreased peripheral perfusion in critically ill patients. They conducted a study on 108 healthy adult volunteers and 37 adult critically ill

patients and divided them into two groups respectively. A total of 216 measurements were carried out in group 1. Seventy-four measurements were carried out in group 2. Capillary refill time (CRT), peripheral perfusion index (PPI) and arterial oxygen saturation were measured in healthy adults (group 1). CRT, PPI, arterial oxygen saturation, central-to-toe temperature difference and hemodynamic variables were measured in critically ill patients (group 2) during different PPI profiles. The distribution of the PPI was skewed and values ranged from 0.3 to 10.0, median 1.4 (inner quartile range, 0.7-3.0) in healthy population. Changes in PPI and changes in core-to-toe temperature difference correlated significantly ($R^2 = 0.52$, $p<0.001$). Therefore, PPI measurements can be used to monitor peripheral perfusion in critically ill patients.

Toyama S et al[5] demonstrated that healthy pregnancy is characterized by a decrease in systemic vascular resistance and increases in total blood volume and cardiac output. However pregnant women, particularly after 30 weeks of gestation, have more blood volume trapped in extremities due to the pregnancy-induced decrease in vascular tone. Toyama did regression analysis and ROC curve analysis and concluded that a baseline perfusion index cut-off point of 3.5 could be used to identify parturients at risk for such hypotension. In order to predict incidence of hypotension using perfusion index, Toyama studied 39 parturients and found that parturients with baseline PI >3.5 had marked hypotension after SAB (using hyperbaric bupivacaine 10 mg and fentanyl 20 microgram) with sensitivity and specificity of 81% and 86% respectively. Thus he concluded that incidence of SAB induced hypotension can be predicted using baseline PI.

Varghese et al[8] showed that peripheral vascular tone can be measured by plethysmography, but the technique is invasive and is not readily available for clinical management in the elective settings. In contrast, non-invasive plethysmographic pulse wave monitoring is found in most pulse oximeters and is readily available for routine use. They conducted a study on 60 parturients divided into two groups on

basis of PI. Group 1 included those with PI>3.5 and group 2, those with PI<3.5. The incidence of hypotension is 86.67% in group 1 whereas it is 6.67% in group 2. The sensitivity and specificity of baseline PI of 3.5 to predict hypotension was 86.67% and 93.33% respectively. Varghese concluded that PI can be used as a predictor of hypotension in parturient during SAB for LSCS. The parturients with baseline PI >3.5 are at higher risk of developing hypotension following SAB compared to those with baseline PI<3.5.

Similar prospective observational study was conducted by Duggappa et al[6] on 126 parturients divided into two groups on the basis of baseline perfusion index. The cut-off value of baseline perfusion index for prediction of hypotension following spinal anesthesia was chosen as 3.5 based on a study conducted by Toyama et al.[5] Group 1 included parturients with PI of <3.5 and group 2 , parturients with PI value of >3.5. SAB was performed with 10mg of injection bupivacaine 0.5% (hyperbaric) at L3-L4 interspace. Statistical analysis was performed using Chi-square test, independent sample t-test and Mann-Whitney U test. Spearman's rank correlation coefficient was done to assess the correlation between baseline PI and hypotension. The incidence of hypotension in group 1 was 10.5% compared to 71.42% in group 2 (P<0.001). They found that there was significant correlation between baseline PI>3.5 and number of episodes of hypotension (r_s0.416, P<0.001) and total dose of ephedrine (r_s0.567, P<0.001). The sensitivity and specificity of baseline PI of 3.5 to predict hypotension was 69.84% and 89.29%, respectively. The area under ROC curve for PI to predict hypotension was 0.848.[6]

Ni H F et al[14] performed a meta-analysis to compare crystalloid co-load with crystalloid preload in parturients receiving SAB for LSCS. The primary outcome was intraoperative incidence of hypotension. Other outcomes were intraoperative need for vasopressors, hemodynamic variables, neonatal outcomes (umbilical artery pH and Apgar score), and incidence of nausea and vomiting. Ten studies with 824 cases were included. The incidence of hypotension was significantly higher in the preload group (57.8%) compared with the co-load group (47.1%).

According to Starling's law, the exchange of fluid is determined by capillary and interstitial fluid hydraulic pressure and oncotic pressure. They also suggested that crystalloid preload may induce atrial natriuretic peptide secretion, resulting in peripheral vasodilatation, followed by an increased rate of excretion of fluid. Further, fluid loading does not increase the intra-vascular volume at the time of maximum vasodilatation. On the other hand, the arterial pressure was better maintained by a fluid bolus just after anesthesia induction compared to preload. Thus they concluded that crystalloid preloading or no fluid administration was less likely effective than crystalloid coload for preventing spinal hypotension.[15]

Dyer et al[16] examined the relevance of the timing of the fluid administered. In this study 50 parturients were randomly allocated to receive either 20ml/kg of crystalloid solution during 20 minutes prior to induction of subarachnoid block (preload), or an equivalent volume by rapid infusion immediately after induction of SAB (coload). Significantly more patients in the coload group did not require vasopressor therapy pre delivery (P=0.047). The coload group required a lower median dose (P=0.03) and a lower median number (P=0.04) of ephedrine dose for the treatment of maternal hypotension predelivery. So, the investigators concluded that rapid crystalloid administration after, the induction of SAB for LSCS, may be advantageous in comparison to preloading 20 minutes prior to institution of SAB in term of managing maternal blood pressure prior to delivery.[16,17]

The physiological objective during spinal anaesthesia for cesarean section is the maintenance of cardiac output, and more specifically uteroplacental blood flow, although heart rate is usually used as a surrogate index of cardiac output. A judicious combination of fluid loading and vasopressor therapy appears the most logical method of achieving this objective. Taken together, these studies suggest that, perfusion index can be used as a tool for predicting hypotension in healthy parturients undergoing LSCS under SAB, the use of PI can aid in the assessment of baseline vascular tone and volume status and

thus needs to be evaluated as a non-invasive validated tool for prediction of severity of hypotension following SAB in pregnant women.

6.3 AIMS AND OBJECTIVES OF THE STUDY

To evaluate the correlation of perfusion index and subarachnoid block induced hypotension in lower segment caesarean section.

7. MATERIALS AND METHODS

7.1 SOURCE OF DATA

A prospective observational study will be conducted in the department of Anaesthesiology, Dayanand Medical College &Hospital, Ludhiana after approval by Institutional Ethics Committee. Parturients undergoing lower segment caesarean section (LSCS) under subarachnoid block (SAB), would be recruited. A total of 120 parturients will be studied. A written informed consent will be obtained from each parturient.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

- American society of Anaesthesiologists (ASA) physical status II undergoing LSCS under SAB.
- Age>18 years.
- Body Mass Index (BMI) < 50 Kg/m^2.
- Singleton caesarean delivery.
- Gestational age 35-40 weeks.

EXCLUSION CRITERIA

- Pre-eclampticparturients.
- Cardiovascular or Cerebrovascular disease.
- Placental implantation abnormalities including placenta previa, placenta accreta and placenta percreta
- Any contraindication to spinal anaesthesia.

Preanaesthetic checkup

A thorough preanaesthetic checkup will be conducted comprising of detailed history (comorbidities, allergy to any drug being used), general physical and systemic examination. Parturients will be explained about the study being conducted and written informed consent will be taken. Relevant investigations will be sent.

Anesthesia technique

The study will be conducted on parturients posted for LSCS under SAB. On arrival in the operating room, the baseline PI will be noted on the right index finger using pulse oximeter probe (Masimo® Rad-97, mexico). Parturients will be positioned on the operating table in supine position with a 15 degree left lateral tilt and intravenous (iv) access will

be gained using 18-G canula in right forearm or hand. Standard monitoring with 5 lead electrocardiography, automated noninvasive blood pressure(NIBP), pulse oximetry using the same Masimo® Rad-97 monitor to measure peripheral oxygen saturation (SpO_2) and PI will be instituted. NIBP will be measured on the left arm(opposite to that used for recording PI).

The mean of three consecutive readings of systolic blood pressure (SBP) at 1 min interval would be taken as the baseline value. Parturients will be administered SAB in sitting or lateral position using full aseptic precautions. All parturients will receive crystalloid co-load of 15ml/kg via a pressurised set to administer the fluid at the maximum possible rate while placement of SAB. After skin infiltration with lignocaine hydrochloride 2% in L3-L4 interspace, SAB will be accomplished using 26-G Quincke's spinal needle. After confirmation of free flow of cerebrospinal fluid(CSF),a total of 2.2ml of drug comprising of 0.5 ml (25 microgram) of fentanyl with 1.7ml(8.5miligram) of hyperbaric bupivacaine will be injected intrathecally and parturients will be returned to supine position with 15 degree left lateral tilt .Oxygen will be given through face mask at 4L/min. Highest level of sensory block will be assessed using an ice cube at 1 min intervals till T4 level is attained. Surgery will be commenced when level of T4-T6 is reached. If a level of T4 is not achieved, the patient will be excluded from the study. NIBP, HR, SpO_2 and PI will be recorded at 1 min interval till the delivery of baby. The time points of SAB administration, surgical incision and delivery of baby will be recorded. Hypotension will be defined as a decrease in systolic blood pressure to less than equal to 80% of baseline value which will be treated with intravenous (iv) boluses of 6mg ephedrine. Bradycardia (HR<60/min) associated with hypotension would be treated with boluses of 6mg iv ephedrine and 0.6mg intravenous atropine and recorded. Rest of the intraoperative management and fluid replacement will be as per the discretion of anaesthesiologist managing the case.

FOLLOWING OUTCOMES WILL BE OBSERVED:

PRIMARYOUTCOME

To evaluate the correlation of perfusion index and subarachnoid block induced hypotension in lower segment caesarean section, hence the following will be observed after administration of SAB.

- Episodes of hypotension (SBP less than equal to 80% of baseline)
- Baseline and subsequent PI values at 1 min interval to delivery of baby

SECONDARYOUTCOME

- Total number of boluses of ephedrine used till the time of delivery.
- Incidence of intraoperative nausea, vomiting (IONV).
- Total Amount of crystalloid administered till the delivery of baby.
- Number of episodes of bradycardia needing intervention till delivery of baby.
- APGAR score at 1 minute and 5 minutes

Episodes of IONV will be recorded using nausea vomiting score:

0: None.

1: Reported Nausea without vomiting.

2: Observed Vomiting.

IONV will be treated with iv ondansetron 4 mg.

Immediately after delivery APGAR scores will be assessed at 1 and 5 minutes, by an independent observer (Attending pediatrician blinded to the study group).

APGAR SCORE

It is an objective method of assessing the newborn condition.

SIGNS	0	1	2
Heart Rate	Absent	Slow Less than 100/min	Normal More than 100/min
Respiration	Absent	Weak cry	Good, strong cry
Muscle tone	Limp	Some flexion	Active movements
Reflex irritability	No response	Grimace	Cough or sneeze
Colour	Blue/pale	Body pink, extremities blue	Completely pink

A total of 7-10 score= normal

4-6 score= fairly low

Less than 3= critically low

STATISTICAL ANALYSIS

The statistical analysis will be carried out using IBM SPSS (Statistical Package for Social Sciences) statistical version 20. The analysis shall include frequency table, bar, pie chart, association of variables based on Chi-square and risk ratio estimates with 95% Confidence Interval. All quantitative variables will be estimated using measures of central location (mean and median) and measures of dispersion (standard deviation). Normality of data would be checked by Kolmogorov Smirnov test. For normality distributed data, Mean will be compared in with respect to parametric inference. For not normality distributed data, Median will be compared using non parametric inference. All statistical tests will be seen at two-tailed level of significance ($p \leq 0.01$ and $p \leq 0.05$).

SAMPLE SIZE

The overall rate of caesarean section delivery in 2015–16 is around 17.2% in India.[18-20]

The sampling technique used in the study is convenient sampling.

$n = (Z^2 \times P (1 – P))/E^2$

n=111 (approximately)

Where Z = value from standard normal distribution corresponding to desired confidence level

(Z=1.96 for 95% CI)

P (.17) is expected true proportion.

E (.07) is desired precision.

With these assumptions a sample size of 111 patients would be included in the study, In addition, accounting for a 15% drop out rate we propose a sample size of 120 patients for our study.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

The study does not require any investigation or intervention other than those routinely done for every parturient for lower segment cesarean section (LSCS).

7.4 HAS ETHICAL CLEARENCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached alongwith.

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PROFORMA

Sr. No.

Age (Years): MRD No.

Height (cm): Weight (Kg): BMI (Kg/m^2):

General physical examination:-

Pulse Rate (Per min)

SBP (mmHg) DBP (mmHg) MAP (mmHg)

Parity

Parturient in active labour: Yes / No

OBSERVATIONS:

1. **TIME OF SPINAL ANAESTHESIA ADMINISTRATION:**
2. **HIGHEST LEVEL OF SENSORY BLOCK 5 MINUTES AFTER INTRATHECAL INJECTION :**
3. **TIME OF DELIVERY OF BABY:**
4. **INTRAOPERATIVE OBSERVATIONS:**

Before the administration of SAB	Perfusion index	SBP	DBP	MAP	HR	SpO2
1 min						
2 min						
3 min						
Mean of three consecutive readings of SBP taken as baseline						

Signature of Candidate **Signature of Supervisor**

After the administration of SAB	Perfusion index	SBP	DBP	MAP	HR	SpO2	Boluses of vasopressors (if used)
1 min							
2 min							
3 min							
4 min							
5 min							
6 min							
7 min							
8 min							
9 min							
10 min							
11 min							
12 min							

INTRAOPERATIVE EVENTS

Episodes of intraoperative hemodynamic events	
1. Hypotension (SBP decrease to less than equal to 80% of baseline	
2. Bradycardia (<60 per minute)	

INTERVENTIONS IF ANY (TILL DELIVERY OF BABY):

Amount of vasopressors (mg) used	
Amount of fluid (crystalloid) used	

Signature of Candidate **Signature of Supervisor**

INTRAOPERATIVE NAUSEA, VOMITING (IONV)

Episodes	**Grading**	**Interventions, if any**
1.		
2.		

APGAR SCORE:

1 min:

5 min:

SIGNS	0	1	2
Heart Rate	Absent	Slow Less than 100/min	Normal More than 100/min
Respiration	Absent	Weak cry	Good, strong cry
Muscle tone	Limp	Some flexion	Active movements
Reflex irritability	No response	Grimace	Cough or sneeze
Colour	Blue/pale	Body pink, extremities blue	Completely pink

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I……..D/o, W/o, S/o……. ……am willing to participate in the study **"PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

……. ……
Signature of the Witness Signature of the patient

Name:

Signature of Supervisor **Signature of Candidate**

मरीज अनुमति फार्म

तिथि _____

मैं _____पत्नी/पुत्र/पुत्री _____
निवासी
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इस शोधकार्य **"PERFUSION INDEX AS A TOOL TO EVALUATE THE INCIDENCE OF HYPOTENSION DURING SUBARACHNOID BLOCK FOR LOWER SEGMENT CAESAREAN SECTION"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुषटि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

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